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TABLE OF CONTENTS

Page

ACKNOWLEDGEMENT i

INTRODUCTION 1

METHODOLOGY 2

ANALYSIS AND INTERPRETATION 9

GENERAL RESULTS AND CONCLUSIONS 10

PHENODYNAMIC TABLE GUIDELINES 12

  READING AND UNDERSTANDING THE ANNUAL PHENODYNAMIC TABLES 13

  LEGEND FOR 1976, 1977, AND 1978 15

DISTRICT INFORMATION:

ELKO 17

WINNEMUCCA 40

CARSON CITY 64

CARSON CITY (NORTH OF RENO) 96

ELY 123

LAS VEGAS 148

BATTLE MOUNTAIN 169

TONOPAH 192

CARROLL SUMMIT 209

CEDARVILLE 237

APPENDIX I 257

ACKNOWLEDGEMENT

The staff of NRC extends thanks to all of the field personnel in each BLM district. Due to everyone's hard work and efforts, the study ran very smoothly this year. We would also like to thank Mike Phillips and Don Jarvis for their interest and cooperation.

INTRODUCTION

This report presents phenological data obtained statewide for the third year of a four year study. The data has been summarized as a means of assisting range managers as they initiate grazing management systems in Nevada. The information presented here will be useful for the accurate prediction of range readiness, flowering or reproductive growth periods, and the prediction of initiation and duration of other plant phenological events.

Objectives:

1. To obtain phenology information for selected species from sites distributed statewide on BLM jurisdiction lands
2. To compare data for the growing seasons for the years 1976, 1977, and 1978 for selected species and sites
3. To present this data to the BLM in a useful format, along with some qualitative interpretations to serve the BLM as a guideline for their use and continued analysis and interpretation

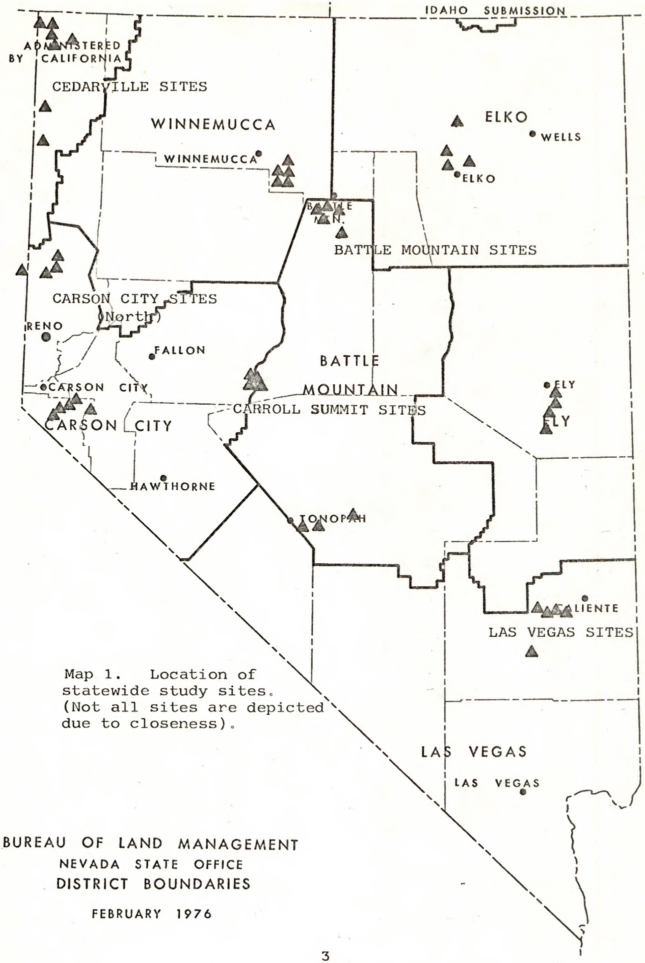
METHODOLOGY

Each BLM district (Elko, Winnemucca, Carson City, Ely, Las Vegas, Battle Mountain [including Tonopah], Cedarville), and NRC, Inc. utilized mostly the same sites as the last two years (Map 1). Carson City (north of Reno) established a new plot in order to gather data on winterfat, budsage and shadscale. BLM personnel at Surprise Resource Area (Cedarville) added several new sites to supplement other studies that they are doing in that area.

Methodology for selection of species and vegetation communities, and methods for measuring vegetation remain the same as the past two years, and can be found in the 1976 and 1977 reports.

NRC staff visited each district at the beginning of the study (or when temporary or summer help began data collection) to answer questions, resolve problems from the 1976 and 1977 studies, and view the study sites.

Average vegetation phenophases and height/leader growths were rated and notated on the same form as used in the past. In addition to soil moisture depth (band of moisture), field personnel collected data on soil temperature. Temperatures (every site/each visit) were collected at the same place each week, 10 to 15 centimeters below the surface. Rain cans to measure precipitation were installed at (almost) every site; Elko utilized soil moisture bars instead of rain cans. All measurements were recorded in millimeters or centimeters and



Map 1. Location of statewide study sites. (Not all sites are depicted due to closeness).

Celsius degrees.

Data gathering began early this year, with some districts beginning as early as January (Las Vegas). Generally, sites were visited weekly March through June, approximately every 10 days in July and August, every other week in September, and at least once in October. Some districts gathered data for November and December. The November data was included in this year's report, but the December data will appear in next year's report.

Each district kept the same representative numeral, and vegetation community numbers remained the same as last year (Table 1). A complete description of each site included elevation, aspect, general soil type and steepness of slope (Table 2).

All phenological and soil moisture data recorded during the study was summarized (annual phenodynamic tables). In order to facilitate interpretation of the table, abbreviations of two key words in a particular phenophase were utilized (i.e., twig growth = TG).

NRC developed graphs comparing various aspects of the 1976, 1977, and 1978 data sets as examples of possible BLM utilization of the data. The same species used in the past were used again.

Four types of graphs were designed; one to three examples of each were illustrated for every district. Phenology of various species in 1976 and 1977 was compared with that of

Table 1. Key numbering system assigned to BLM district and NRC sites.

DISTRICT	NUMBER
Elko	01
Winnemucca	02
Carson City	03
Carson City (North of Reno)	03A
Ely	04
Las Vegas	05
Battle Mountain	06
Tonopah	06A
Carroll Summit	07
Cedarville, CA (Northern Washoe County)	09

VEGETATION TYPE	NUMBER
Southern desert shrub	-1
Salt desert shrub	-2
Northern desert shrub	-3
Seeding	-4
Pinyon/juniper	-5
Mountain meadow	-7
Coniferous forest	-8
Salt marsh	-9
Degraded with annual grasses	-10
Riparian	-11

Table 2. Elevation, aspect, slope and soil type of BLM and NRC, Inc. sites in Nevada utilized for data gathering.

SITE	ELEVATION	ASPECT	% OF SLOPE	SOIL TYPE
Las Vegas:				
05-1-1 (So.D.S.)	2,780	Level	0	-
05-1-2 (So.D.S.)	4,080	South	3	Sandy loam
05-2 (S.D.S.)	4,800	Level	0	Loam
05-3 (N.D.S.)	5,600	Level	0	Loam
05-7 (M.B.)	6,000	S.W.	15	Sandy clay loam
Carson City:				
03-2-1 (S.D.S.)	5,040	Level	0	Gravely sand
03-3-1 (N.D.S.)	5,080	Level	0	Sandy
03-3-2 (N.D.S.)	5,326	East	2	Sandy
03-5-1 (P/J)	5,720	West	1	Rocky-sandy
03-5-2 (P/J)	6,880	East	5	Sandy
03-5-3 (P/J)	6,840	N.W.	5	Rocky
03-5-4 (P/J)	6,410	West	2	Meadow
03-7-1 (M.B.)	7,800	North	10	Sandy rocky loam
03-7-2 (M.B.)	7,260	N.W.	5	Rocky-sandy
03-7-3 (M.B.)	6,280	East	1	Sandy
03A-3 (N.D.S)	5,000	N.E.	10	Sandy
03A-4 (seeding)	5,400	South	5	Sandy
03A-5 (P/J)	5,200	N.E.	19	Sandy
03A-7-1 (M.B.)	5,740	Level	0	Sandy
03A-7-2 (M.B.)	6,400	N.E.	53	Sandy loam
03A-2 (S.D.S. new)	4,240	S.E.	1-4	Sandy
Tonopah:				
06A-2-1 (S.D.S.)	6,170	North	6	Clay loam
06A-2-2 (S.D.S.)	5,520	East	3	Sandy loam
06A-3 (N.D.S.)	6,400	East-wash	6	Sandy loam
Elko:				
01-3 (N.D.S.)	6,170	N.E.	4	Clay loam
01-4 (seeding)	5,870	N.E.	4	Clay loam
01-6 (M.M.)	5,676	Level	0	Loamy sand
01-7 (M.B.)	6,266	North	40	Silty clay loam
01-10 (A. grass)	5,676	S.W.	4	Sandy loam
Battle Mountain:				
06-2-1 (S.D.S.)	4,547	Level	0	Sandy
06-2-2 (S.D.S.)	4,740	S.E.	5	Clay

Table 2 Continued-

SITE	ELEVATION	ASPECT	% OF SLOPE	SOIL TYPE
06-2-3 (S.D.S.)	4,590	East	2	Sandy loam
06-3 (N.D.S.)	6,100	West	85	Rocky
06-7 (M.B.)	6,150	East	-	-
Winnemucca:				
02-2 (S.D.S.)	4,800	East	2	Loamy
02-3-1 (N.D.S.)	6,200	S.E.	25	Clay skeletal
02-3-2 (N.D.S.)	5,200	East	4	Loamy
02-6 (M.M.	6,900	S.E.	8	Clay skeletal
02-7 (M.B.)	7,200	S.E.	21	Clay skeletal
02-11 (Riper.)	5,600	East	7	Loamy
Ely:				
04-2 (S.D.S.)	6,600	West	5	Loam
04-3 (N.D.S.)	6,800	East	5	Loam
04-5 (P/J)	7,520	S.E.	5	Loam
04-6 (M.M.)	7,280	South	5	Silty loam
04-7 (M.B.)	8,000	Level	0	Stony loam
04-8 (Con.F.)	8,600	N.W.	30	Stony loam
04-9 (S.M.)	6,520	East	5	Silty loam
Carroll Summit:				
07-2 (S.D.S.)	5,200	N.W.	4	Stony loam
07-3 (N.D.S.)	6,080	S.W.	3	Loam
07-5 (P/J)	6,650	South	38	Sandy loam
07-6 (M.M.)	7,360	N.W.	14	Clay loam
07-7 (M.B.)	7,520	North	40	Rocky loam
Cedarville:				
09-2-1 (S.D.S.)	5,400	Level	0	-
09-2-2 (S.D.S.)	5,700	-	-	-
09-2-3 (S.D.S.)	5,700	Level	0	-
09-3 (N.D.S.)	5,500	-	-	-
09-4 (seeding)	-	-	-	-
09-5 (P/J)	5,800	East	7	-
09-2-4 (S.D.S.)	-	-	-	-
09-3-3 (N.D.S.)	-	-	-	-

the same species for 1978. Any possible correlation between soil moisture depth and phenophases of plants in the three years was depicted. In addition, soil moisture depth and its effect on height/leader growth in the three data sets were contrasted. In both of the aforementioned types of graphs, an "S" represents surface moisture and "D" represents soil dry (moisture found at a level greater than 30 centimeters). Bar graphs illustrating time of leaf growth and twig growth for shrubs; growth starts, full bloom, plants dry for forbs; and ½ vegetative growth, flower stalks first appear, seed dissemination, and plants dry for grasses were formulated. These graphs will enable range managers to discern at a glance the time period in which important phenophases occur and how they vary from year to year.

Graphs and complete data sets for each district are listed by district, and include a discussion with each. A district map showing specific location of each sample site is provided.

Common and scientific names of all plants used in the study are listed in Appendix I.

In order to facilitate interpretation of the data sets, please refer to "Reading and Understanding the Annual Phenodynamic Tables".

ANALYSIS AND INTERPRETATION

At the end of the 1979 growth season, this project will have generated four years of data for plant phenology of important range plant species on a statewide basis. A good cross-section of the important range sites and environments will have been sampled. Such data is relatively not available in Nevada or elsewhere, and so constitutes an important data base upon which to base grazing management systems.

The data have been summarized and plotted in various ways and interpreted primarily in a subjective way. It should be suggested that a closer, more objective look at the data be made. In other words, the data should be further analyzed and certain relationships should be tested statistically. The strength of some of the general correlations between phenophase development and influential parameters such as soil moisture, soil temperature, and precipitation should be quantitatively evaluated.

In order to accomplish these analyses, it would be useful to key punch the data onto cards for computer analysis. Several statistical routines should be used to test the relationships suggested during the course of the study. The purpose would be to determine the probability that these relationships will hold true during the time frame of proposed management plans designed for rangelands in the future.

GENERAL RESULTS AND CONCLUSIONS

Full benefit from the data will be derived only after the information has been entered into the computer, where a series of comparisons can be easily made (see section on Analysis and Interpretation). After three years, however, it appears that some patterns are emerging relative to the growth and development of the key species measured or followed during these studies.

There are some relatively prominent relationships between the development of a given species and the contemporary moisture and temperature patterns. There appears to be some strong correlations between the initiation of twig and leaf growth and the receipt of some level of precipitation during the preceding 30 days. There is also quite likely an interaction with soil temperature. For example, the development of grasses is highly dependent upon April, May, and June precipitation, but significant growth of both vegetative and reproductive culms does not occur until soil temperatures warm up above 12-13 ^{o}C. The third year's data points this out clearly, and while this has generally been a known factor about grass development, the data presented here will better establish the timing and thresholds for development that have been difficult to determine in the past.

For some species at some sites, plotting of all three years showed that the phenophases were extremely close. In other words, development was essentially the same for all three years. This included the initiation of growth, the length of the reproductive period and onset of maturation. All phenophases occurred on nearly the same dates and for the same number of days. However, the opposite was true for numerous other species, wherein the phenodynamic showed considerable variation when the three years were compared.

Many grasses and forbs, as in 1976 and 1977, complete their life cycle more rapidly when soil moisture is limiting. Some species show this potential, while others do not. The amount of variation found suggests that there may be no pat answers to phenodynamics analyses. These data strongly suggest that each site selected for a grazing management program will require an evaluation of the phenodynamics of key species. Hopefully, this statewide study will provide information that can be used directly or extrapolated to specific sites to satisfy the data demands of BLM range conservationists in this work.

PHENODYNAMIC TABLE GUIDELINES

READING AND UNDERSTANDING THE ANNUAL PHENODYNAMIC TABLES

To facilitate interpretation of the data, look at the "Symbol Sheet" with the phenophase abbreviations.

Each graph is divided into months which are subdivided into weekly time periods. An abbreviation appearing within the first time period signifies that it occurred approximately between day 1 and day 7 of that month.

Soil moisture depth is listed in centimeters for all sites. The first number represents where moisture started (distance from the top of the surface), and the second shows to what depth the moisture continues. If the latter number is listed with no period after it, the moisture is considered to continue (i.e., 15-30 =15-30+ centimeters). Field personnel were often unable to dig much deeper due to hardpan, rocks, etc. If soil moisture is listed with a period after it, the moisture is considered as stopping at that point (i.e., 5-8.). Soil temperature is listed in Celsius degrees, and precipitation, in millimeters.

The scientific symbol for each plant is listed with its phenophases depicted. Phenophases are listed once and considered to continue until another phenotype is depicted.

Toward the latter months, some species had regrowth and that is shown with underlining.

In September, October, and November, data was sometimes collected only once or twice per month; therefore, some phenophases may have been missed. In these instances, phenophases in-between will have to be interpolated.

Various abbreviations have been used on the graphs. The following is an explanation:

gu = green up
sn = snow
fr = frozen
gr = grazed

Legend for 1976, 1977, and 1978.

1976	1977	Data Sheets	Phenophase
SHRUBS	SHRUBS		
	D	0-9	Dormant
\\	LG	10-19	Leaf Growth
////	TG	20-29	Twig Growth
○	BV	30-39	Flower Buds First Visible
□	FG	40-49	Leaves Full Grown
◊	1B	50-59	First Bloom
⧫	FB	60-69	Full Bloom
●	BO	70-79	Bloom Over
△	SR	80-89	Seed Ripe
▲	SD	90-99	Seed Dissemination
◇	LY	100-109	Leaves Turn Yellow
◆	LD	110-120	Leaves Dry & Drop
GRASSES	GRASSES		
	D	0-9	Dormant
\\	GS	10-19	Growth Starts
□	½V	20-29	½ Vegetative Growth
○	FS	30-39	Flower Stalks Appear
⧫	HO	40-49	Heads Out Fully
✳	An	50-59	Anthesis
◬	DS	60-69	Dough Seed Set
△	HS	70-79	Hard Seeds
▲	SD	80-89	Seed Dissemination
◇	BD	90-99	Plants Begin to Dry
◆	PD	100-	Plants Dry-Summer

Legend for 1976 and 1977

1976	1977	Data Sheets	Phenophase
FORBS	FORBS		
	D	0-9	Dormant
⑊	GS	10-19	Growth Starts
○	FS	20-29	Flower Stalks Appear
◊	1B	30-39	First Bloom
⧫	FB	40-49	Full Bloom
⟠	BO	50-59	Bloom Over
△	SR	60-69	Seeds Ripe
▲	DS	70-79	Dissemination Starts
◇	BD	80-89	Plants Begin to Dry
◆	PD	90-	Plants Dry
⬡	GR		Grazed

Soil Moisture Depth:

S= surface moisture

D= soil dry

BR= any soil condition which prevents further digging. (i.e, hardpan, rocks, etc.)

fr= frozen

gr= grazed

gu= green-up

sn= snow

ELKO

Elko field personnel noted on their weekly sheets that the willow (Salix alba) on their mountain meadow site (01-6) did not bloom at all this year. Also, a new species of buttercup (Ranunculus testiculatus) appeared for the first time on their seeding plot (01-4).

Elko utilized soil moisture bars instead of rain cans to measure their "precipitation". While studying their annual phenodynamic tables, it should be kept in mind that -.2 represents saturation of the soil, -5.5 represents dry, and -15 means wilting point for the plants. Their readings of -60, therefore, represent extremely dry soil!

Field personnel took upper site (U) and lower site (L) measurements for soil temperature, etc. on their mountain brush site (see annual phenodynamic tables, 01-7). For simplicity, this site may be divided into two sites next year.

Examination of the phenodynamics for their sites reveals no extraordinary patterns. Grass species show a general drying and seed dissemination corresponding with high soil moisture bar readings (resistance), indicating rapid drying of the soil. Soil moisture offers a substantial clue to the growth, particularly seed development, in the grass species. The forbs generally show a similar pattern, with the possible exception of hoary aster (Machaeranthera canescens), which seemed to complete its life cycle during a relatively dry period.

Leader length and height of grasses showed the same erratic results (Table 1) as experienced at many of the other sites. No significant patterns are apparent with this interpretation. Further analysis may be required.

The three year comparison of the phenodynamic of antelope bitterbrush (Purshia tridentata) shows a striking similarity (Figure 1). The flowering phenophases occur over a period from two to four weeks long, depending on the year.

A similar plotting of Sandberg bluegrass (Poa sandbergii; Figure 2) and squirreltail grass (Sitanion hystrix; Figure 3) shows considerable phenological variation for the former and less annual correspondence for the latter. Height growth of squirreltail grass (Figure 4) was greater in 1976 and 1978 than in 1977. The reasons for this are not clear. Possibly, interactions with temperature and soil moisture were influential. Height growth for rabbitbrush (Chrysothamnus viscidiflorus) also shows considerable variability (Figure 5).

Figure 6 shows a very consistent pattern for various grasses with respect to the onset of vegetative growth. The appearance of flower stalks and seed dissemination shows much more variation.

Leaf growth of shrubs varies by species (Figure 7), as does twig growth. For example, twig growth of rabbitbrush tends to begin sooner than for buckwheat (Eriogonum sp.) and bitterbrush. The developmental variation for lungwort (Mertensia oblongifolia) and arrowleaf balsamroot (Balsamorhiza sagittata) is variable (Figure 8), but there are no significant patterns represented by the three year comparison.

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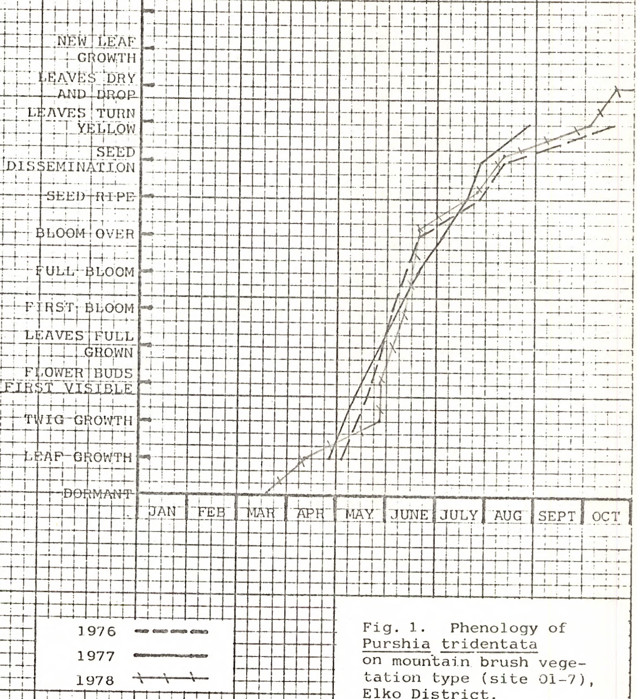

Fig. 1. Phenology of *Purshia tridentata* on mountain brush vegetation type (site 01-7), Elko District.

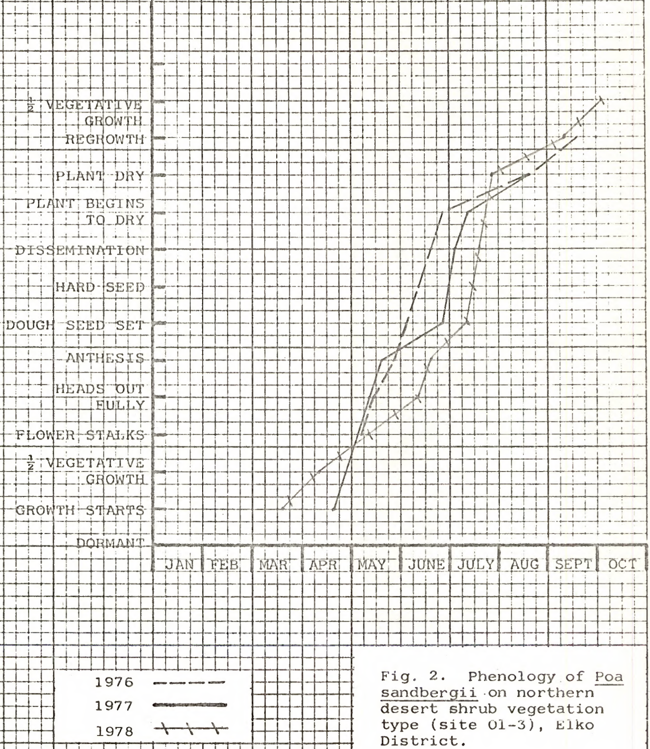

Fig. 2. Phenology of Poa sandbergii on northern desert shrub vegetation type (site 01-3), Elko District.

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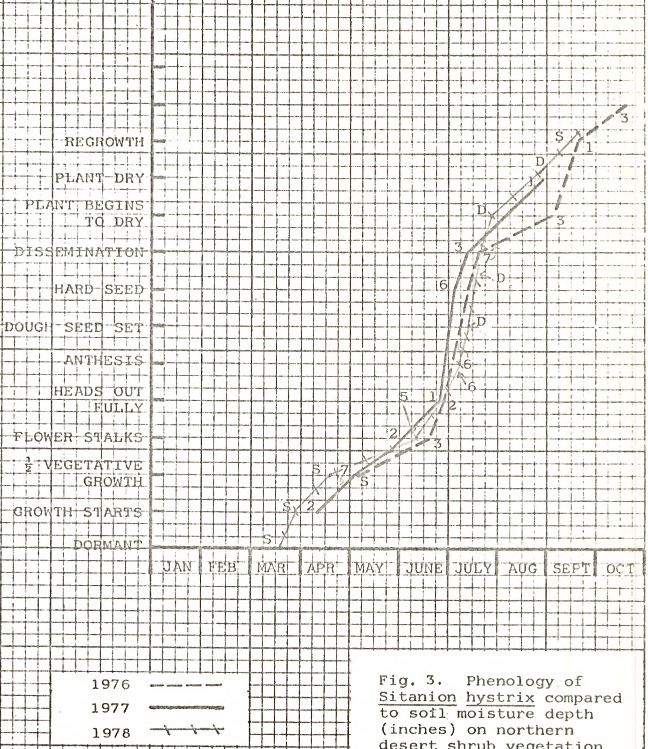

Fig. 3. Phenology of Sitanion hystrix compared to soil moisture depth (inches) on northern desert shrub vegetation type (site 01-3), Elko District.

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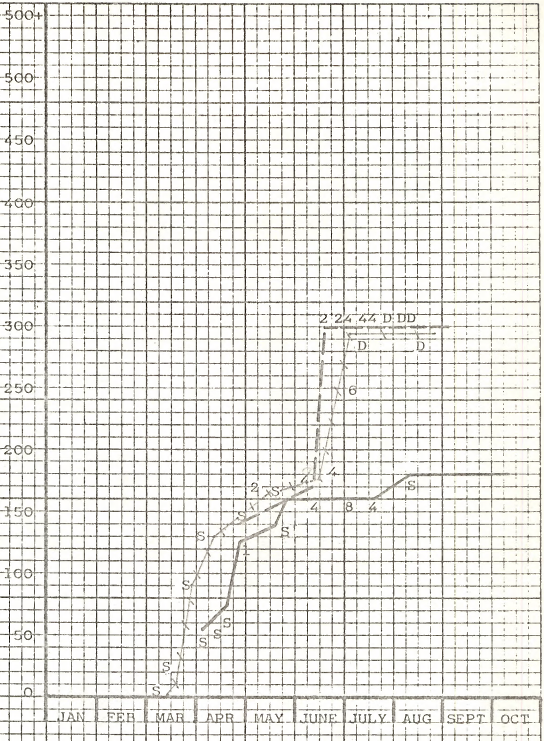

Fig. 4. Height growth (mm) of Sitanion hystrix compared with soil moisture depth (inches), mountain brush vegetation type (site 01-7), Elko District.

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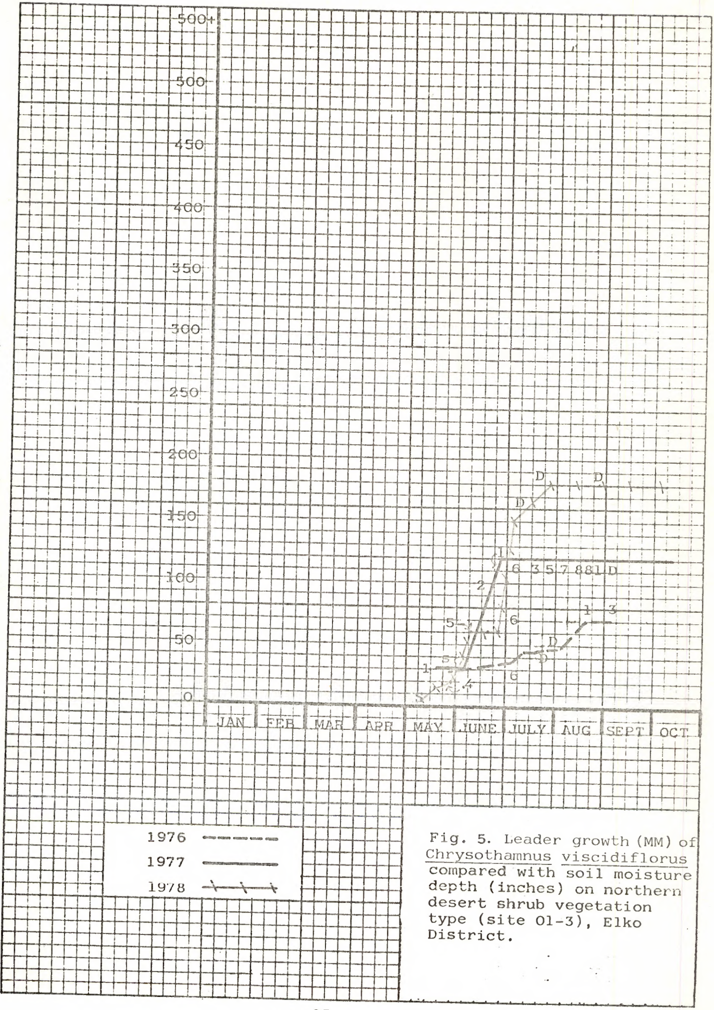

Fig. 5. Leader growth (MM) of Chrysothamnus viscidiflorus compared with soil moisture depth (inches) on northern desert shrub vegetation type (site 01-3), Elko District.

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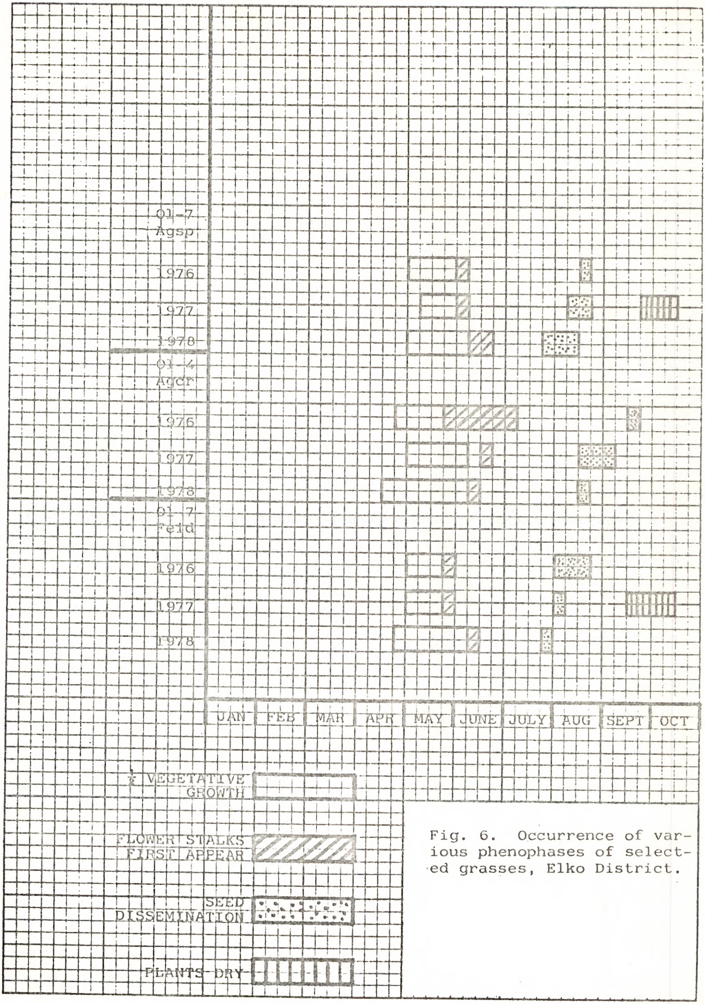

Fig. 6. Occurrence of various phenophases of selected grasses, Elko District.

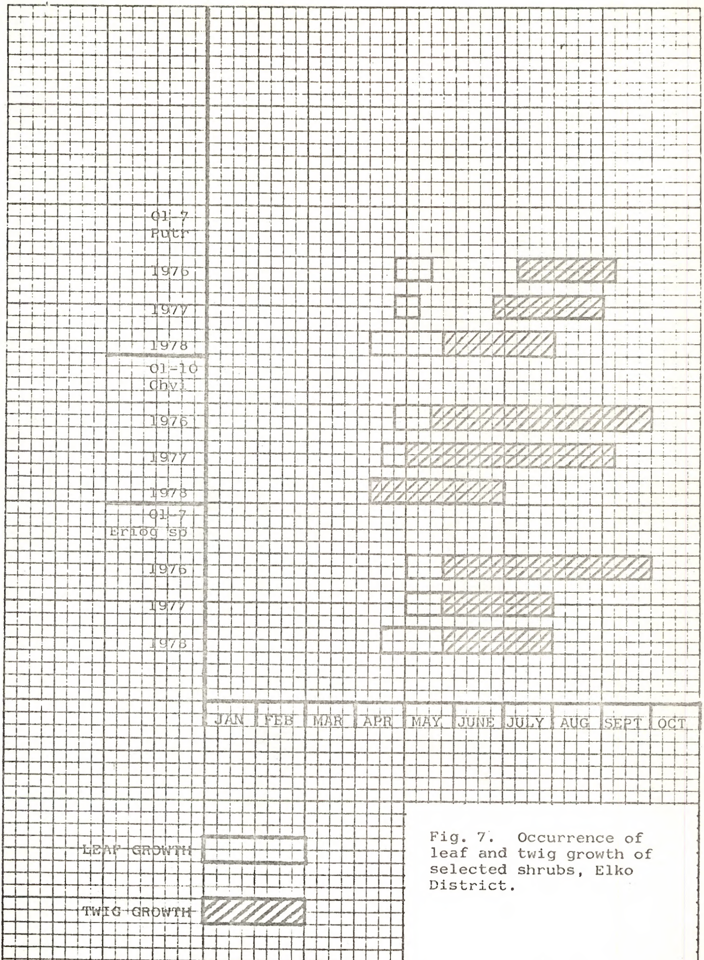

Fig. 7. Occurrence of leaf and twig growth of selected shrubs, Elko District.

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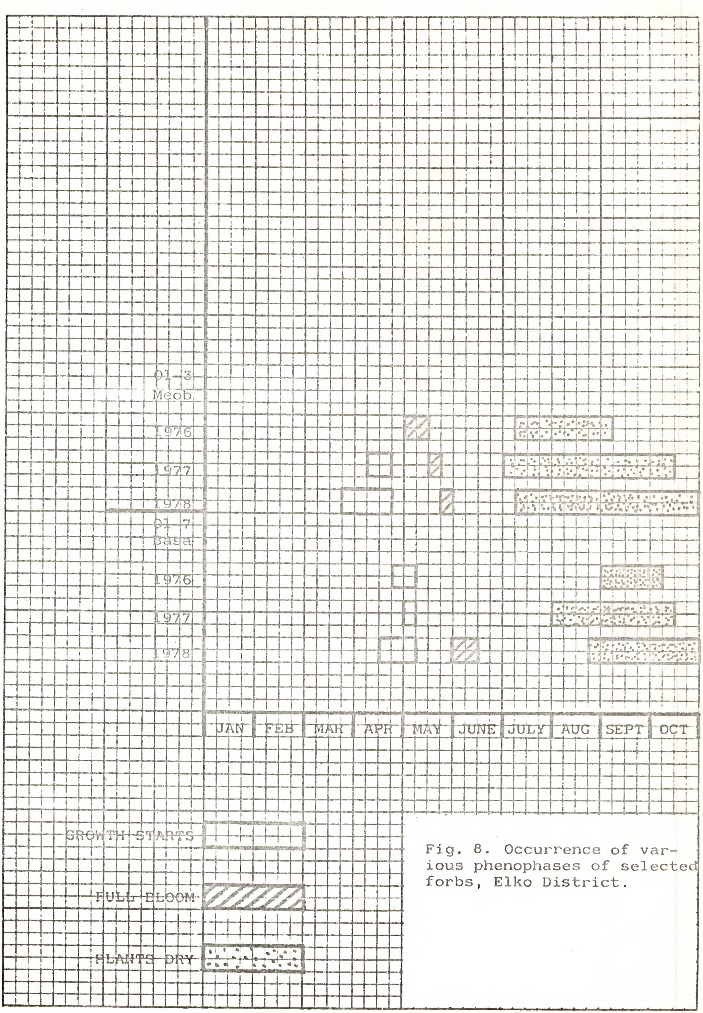


Fig. 8. Occurrence of various phenophases of selected forbs, Elko District.

Table 1. Leader (Shrubs) and Height (Grasses) Growth in the Elko District for 1976, 1977, and 1978.

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 01-3						
SHRUBS						
1. Artr	70		110		140	
2. Chvi	70		120		180	LG*
GRASSES						
1. Elci	750		820		1000	
2. Stwe	220	100	200		250	
3. Posa	300	60	200		230	95
4. Sihy	300	100	240		250	130
FORBS						
1. Lone	50		40		80	
2. Meob	92		80		120	
3. Asle	110				170	10
4. Phlox sp.			50		50	9
5. Lule	110		100		210	
Site 01-4						
SHRUBS						
1. Artr	110		200		150	
2. Chnac					240	
GRASSES						
1. Agcr	380		370		450	155

---

*Leaf growth

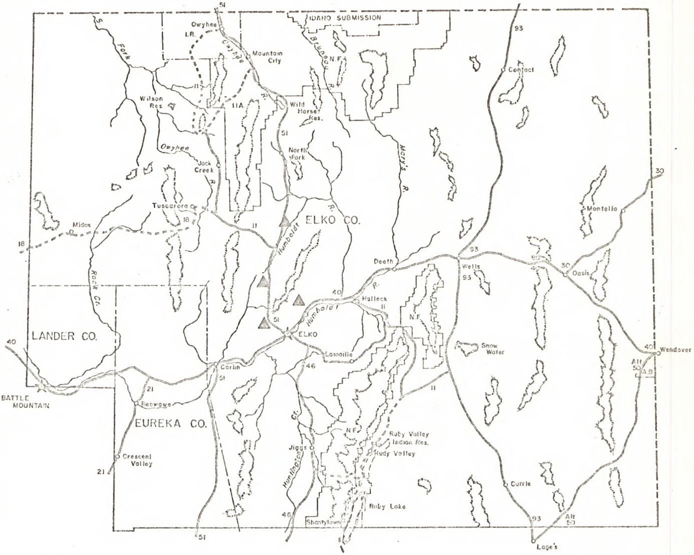
	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
01-4 Con't.						
2. Sihy	200		210		2310	100
3. Posa	200		230		140	55
FORBS						
1. Phlox sp.	30		90		25	2
2. Rate					25	
Site 01-6						
SHRUBS						
1. Saal	1000		470		370	
GRASSES						
1. Cane	650		450		550	
2. Juba	740		570		600	
3. Agst			540		900	
4. Popr			450		800	
5. Brin			760		1130	
FORBS						
1. Fraga sp.	500				could not find	
2. Migu	220				450	
3. Rumex sp.	700		670		920	
4. Mear			250		540	
Site 01-7						
SHRUBS						
1. Artr	210		160		205	
2. Putr	70		110		135	
3. Chvi	220		140		150	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
01-7 Con't.						
4. Rosa sp.	90		100		80	
5. Eriog sp.	270		100		150	
6. Arar	150		110		200	
7. Chnac	200		210		270	
8. Amut			50		122	
GRASSES						
1. Feid	570		480		460	100
2. Elci	1230		960		1350	
3. Posa	350	50	230		300	70
4. Agsp	610	100	530		450	105
5. Sihy	300	100	180		300	125
6. Stth	470	70	230		450	
7. Brte					140	55
FORBS						
1. Meob	180		100		160	
2. Basa	600		270		450	
3. Maca	260				400	
4. Ragl					90	
5. Lupin sp.					320	
Site 01-10						
SHRUBS						
1. Artr	140		190		290	
2. Chvi	100		160		150	LG*

---

* Leaf growth

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
01-10 Con't.						
GRASSES						
1. Brte	320	100	160		380	55
2. Elci	1330		940		1600	
3. Agda			510		550	130
4. Posa			300		115	
FORBS						
1. Sial	250		310		750	10
2. Erci	90	20	140		300	30



▲ SITE LOCATIONS
(Not all shown due
to closeness)

ELKO DISTRICT

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV 1	2
SMD(From-To in cm)				S 30	S 30		S 30	S 30	S 30	S 30	2 30	5 30	1 30	7 30	13 30	10 30	15 30	D	D	D	D	D	D	D	D	D	S 30	S 30	4 30		5 30	9 30	6 30	S5. 10 30	
SM Blocks				-2	-4		-3	-3	-2	-4	-7	-1	-1.5	-3	-4.5	-6.5	-15	-60	-60	-60	-60	-60	-60	-60	-60	-60	-2	-5	-1	-1.5	-2.5	-4	-4.5	-5	
S.T.-°C				1	7		6	4	7	3	8	14	4	11	14	20	16	19	19	18	30	32	29	25	23	16	11	5	13	9	10	8	5	6	
Elko 1-3																																			
SHRUBS																																			
rtr				D							TG							BV					FG						1B				BO		S
hvi				D			LG			TG								BV			FG	1B		FB		BO	SR	SD		LY	LY LG	LY LD			
RASSES																																			
lci				D	GS						½V						FS	HO	A n		DS		SD	BD					PD						
twe				D	GS			½V							FS		An		HS	BD															
osa				GS			½V				FS				HO		An		DS	SD	PD						GS			½V				BD	
ihy				D	GS			½V							FS		HO	An	DS	SD	BD				PD			GS							B
ORBS																																			
sle				D					GS	FS	1B	FB				BO		SR		PD											GS				
one				D	FS		1B	FB					BO		SR	DS		BD		PS															
ule				D			GS				FS		1B	FB		BO			SR	PD															
eob				D	GS				FS	1B			FB	BO	SR	DS	BD		PD																
hlox sp.				D	GS						1B	FB			BO		SR		DS	BD					PD				GS				FS	FB	F

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV 1	24
SMD (From-To in cm)				S 30	S 30	S 30	S 30	S 30	5 30	5 30	2 30	7 30	2 30	10 30	17 30	10 30	25 30	D	D	D	D	D	D	D	D	D	S 30	S 30	5 30	-	8 30	8 30	15 30	S5 20 30	fr
SM Blocks				-.2	-.2	-.2	-.2	-.2	-.2	-.3	-.5	- 1	-1.5	-.6	-9.5	-35	-60	-60	-60	-60	-60	-60	-60	-60	-60	-60	-.2	-.4	-.8	-1.5	-3	-6.5	-12	-20	-6
S.T.-°C				1	7	2	7	5	8	2	8	18	6	11	16	27	21	24	19	18	32	33	29	26	17		12	5	12	8	9	7	3	5	fr
Elko 01-4																																			
SHRUBS																																			
Artr				D							LG	TG						BV					FB					1B		FB			BO		SD
Chnac				D							LG	TG						BV			FG	1B		FB			BO	SR	SD						
GRASSES																																			
Agcr				D	GS			½V							FS	HO		An		DS			SD	BD				GS							BI
Posa				GS					½V							BD		HS	SD		PD						GS			½V				BD	
Sihy				D	GS				½V					FS			HO	An DS	HS	SD	BD				PD			GS							BI
FORBS																																			
Phlox				D	GS							1B		FB	BO			SR DS			BD					PD			GS						BD
Rate									1B		BO						SR	DS	BD	PD															

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV 1	24
SMD(From-To in cm)					S 30	S 30	S 3 0	S 30		S 30	S 30	S 30		S 30	S 30	S 30	S 30	S 30	S 30	S 30	S 30	S 30	S 30	S 30	S 30	S 30	S 30	S 30	S 30	9 30	S 30	S 30	S 30	S 30	S 30
SM Blocks					-.2	-.2	-.1	-.1		-.2	-.1	-.2		-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-2
S.T.-°C					7	5	10	7		7	10	14		10	12	12	12	13	13	17	17	17	15				11	9	11	9	9	9	6	7	2
Elko 01-6																																			
SHRUBS																																			
Saal					D					LG		TG														FG						LY	LD		
GRASSES																																			
Brin					GS							$\frac{1}{2}$V							An	HS				SD					BD						
Popr					GS						$\frac{1}{2}$V	FS			HO			An DS	HS		SD								BD						
Juba					GS						$\frac{1}{2}$V	FS		HO			An		DS		HS											SD		BD	
Cane					GS						$\frac{1}{2}$V	FS		FS	HO	An			DS	HS						SD			BD						
Agst																								An	DS	HS	SD		BD						
FORBS																																			
Rumex sp.					GS												FS	1B	FB	BO		SR			DS	BD									
Mear														GS				FS				1B	FB		BO	SR	DS	BD				PD			
Migu										GS								FS 1B	FB		BO		SR				DS	BD				PD			

		F	MARCH				APRIL				MAY				JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER				NOV	
																																			1	2
S.T.(°C)	U				0	7		12	5	7	2	14	20	6	14	18	30	18	23	31	20	33	35	31	30	30	19	10	6	15	12	13	11	7	6	s
	L				0	3		8	3	5	1	10	17	4	8	16	25	17	20	25	19	26	30	29	24	23	16	8	3	9	6	7	6	5	4	s
SMD (From-To in cm)	U				S 30	S 30		S 30	S 30	S 30	1 30	2 30	6 30	S 30	3 30	11 30	11 30	15 30	D	D	D	D	D	D	D	D	D	S 30	S 30	2 30		8 30	10 30	10 30	S 30	s
	L				S 30	S 30		S 30	S 30	S 30	1 30	2 30	2 30	S 30	2 30	10 30	10 30	15 30	D	D	D	D	D	D	D	D	D	S 30	S 30	S 30		8 30	5 30	10 30	S 30	s
SM BLOCKS	U				-.2	-.25		-.2	-.2	-.2	-.4	-1	-2.5	-.4	-2.5	-5	-11	-35	-60	-60	-60	-60	-60	-60	-60	-60	-60	-.2	-.3	-1.5	-4.5	-7			-14.5	sn
	L				-.2	-.25		-.2	-.2	-.2	-.2	-.2	-.3	-.3	-.5	-1.5	-2.5	-5.5	-12	-30	-60	-60	-60	-60	-60	-60	-60	-.2	-.2	-.4	-1	-3	-6	-8.5	-9	s
Elko 01-7																																				
SHRUBS																																				
Amut					D			LG						TG BV	FG	1B	BO		SR			SD						LY			LD					
Arar					D							LG	TG						BV					FG						1B	FB			BO	SD	
Artr					D							TG							BV					FG						1B	FB			BO	SD	
Chnaa					D			LG								TG					BV			FG						1B	FB			BO	SD	
Chvi					D			LG				TG							BV			FG														
Eriog sp.					D				LG					TG			BV		FG			1B		1B				FB				BO		LY	SD LY	
Putr					D			LG						TG BV		1B	BO					SR		SD							LY		LD			
Rosa sp.					D			LG		TG						BV		1B	FB	BO	SR							SD				LY		LD		
GRASSES																																				
Agsp					D	GS					½V					FS		HO	An	DS		SD			BD					GS						

		F	MARCH				APRIL				MAY				JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER				NOV	
S.T.(°C)	U																																			
	L																																			
SMD (From-To in cm)	U																																			
	L																																			
SM BLOCKS	U																																			
	L																																			
Elko 01-7 cont																																				
GRASSES																																				
Elci					D	GS						½V					FS		HO	An		DS	SD HS	SD		BD								PD		
Feid					D	GS				½V						FS	HO	An	DS	HS		SD	BD							GS						
Posa					GS					½V							FS	BD	HS	SD								GS			½V					
Sihy					D	GS			½V								FS	HO	An DS	HS	SD		BD						GS							
Stth					D	GS			½V								FS	HO	An	DS	SD			BD												
Brte					GS							FS			HO			DS	HS SD	BD		PD							GS							
FORBS																																				
Basa					D				GS			FS		1B	FB		BO	SR	DS			BD				PD										
Lupin sp.					D					GS		FS				1B	FB			SR	DS	BD								PD						
Maca					D														FS	1B				FB		BO	SR	DS	BD							
Meob					D	GS					FS	1B		FB		BO		DS	BD		PD															
Ragl					GS	FB				SR	DS			PD																						

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV 1	24
SMD(From-To in cm)					S 30	S 30	S 30	30		S 30	1 30	9 30		4 30	12 30	14 30	21 30	3 30	10 30	25 30	D	D	D	D	D	S 30	S 30	S 30	1 30	8 30	11 30	15 30	15 30	0-5	5 3
SM Blocks					-2	-2	-2	-2	-2	-.2	-.4			-2.5	-6	-14	35	-12	-15	-60	-60	-60	-60	-60	-60	-60	-.2	-.2	-.9	-5.	-11	-15	-20	-30	-8
S.T.-°C					0	5	15	9		7	12	15		13	15	19	18	20	27	35	37	24	36	31	31	16	11	14	19	13.5	13	11.5	8	10.5	4
Elko 1-10																																			
SHRUBS																																			
rtr					D						TG							BV				FG							1B	FB			BO		SD
hvi					D		TG											BV			FG	1B		FB			BO	SR	SD			LY LG	LD LG		
RASSES																																			
gda					GS						½V					FS	HO	An	DS	HS				SD	BD		PD	GS							
rte					GS						FS			HO		An		DS HS	SD	BD	PD						GS							BD	
lci					GS						½V					FS	HO		An	DS		HS		SD		BD								PD	
osa					GS	½V				FS			HO			DS		HS BD		BD	PD						GS		½V				BD		
ORBS																																			
rci					GS					FS	1B			FB				SR	DS	BD	PD						GS								
ial					GS							FS			1B	FB			BO			SR				DS	BD			GS					

WINNEMUCCA

WINNEMUCCA

Winnemucca field personnel noted several interesting facts on their weekly data sheets. They wrote that last year's mature leaves were green as early as February 24, 1978, for squirreltail grass (*Sitanion hystrix*) on site 3-2, a northern desert shrub type. Also, thistle (*Cirsium* sp.) went directly from "growth starts" to "dry", with no flower stalks appearing (site 2-11).

Relatively good April and June precipitation tends to regulate plant development. Generally, the good April precipitation (1978) resulted in rapid growth rates of grasses, rapid elongation of twigs, and early bloom in forbs. The three year comparison of data reveal no important irregularities.

Vegetative growth of bluebunch wheatgrass (*Agropyron spicatum*) continued for a much longer period in 1978 than the other two years (Figure 1). This may, of course, be a result of variability among samplers. Other grasses do not show any significant changes (Figures 1 and 2).

Height growth of the annual cheatgrass (*Bromus tectorum*) seems to be regulated by April-May soil moisture depth (Figure 3). Good soil moisture after June does not revive this short-lived species. Leader growth of rubber rabbitbrush (*Chrysothamnus nauseosus*; Figure 4) shows a similar relationship, with elongation continuing into July and August.

The development of bud sagebrush (Artemisia spinescens) was very similar for all three years (Figure 5). This species completes its annual growth cycle from April 1 through about June 15 each year. Longflower snowberry (Symphoricarpos longiflorus) shows greater variation at the higher elevations where it is found (Figure 6). Most activity for this species occurs between June 1 and August 30. For squirreltail grass (Sitanion hystrix; Figure 7), the most active period is between May 1 and July 1, but a phenophase may occur up to four weeks apart from year to year.

An overall look at the leader and height growth data (Table 1) suggests that 1978 was a better growth year than 1977 on most sites, but not necessarily better than the growth recorded in 1976. Also, several species showed regrowth in 1978, but not in 1976 and 1977. Additional correlation analyses with soil moisture and/or precipitation will be required to test the predictability of these relationships.

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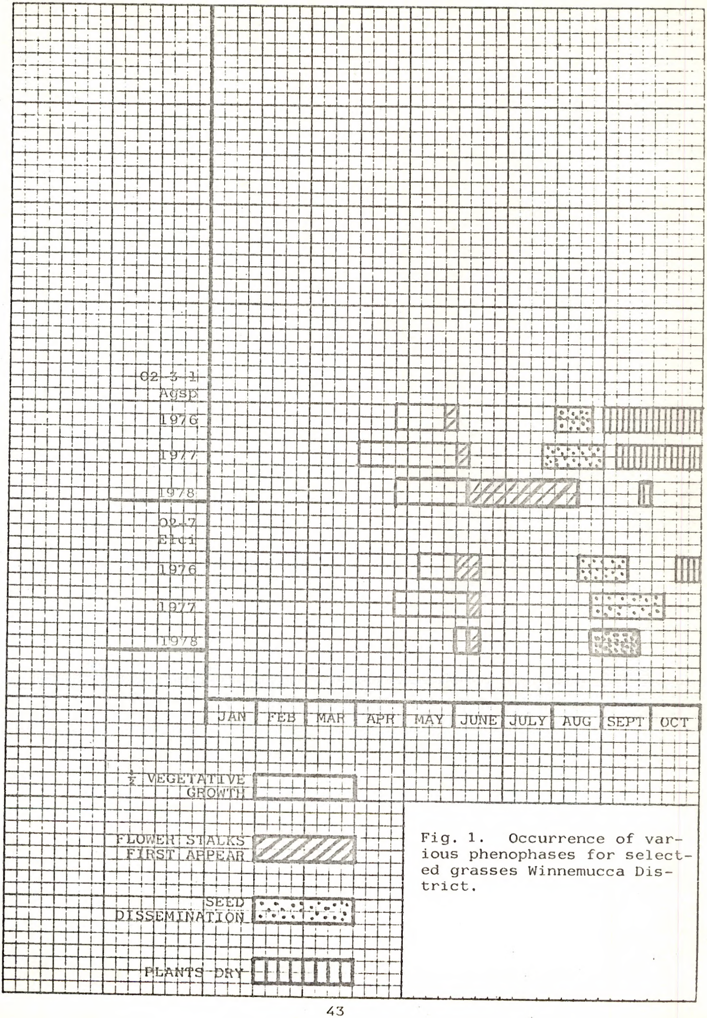

Fig. 1. Occurrence of various phenophases for selected grasses Winnemucca District.

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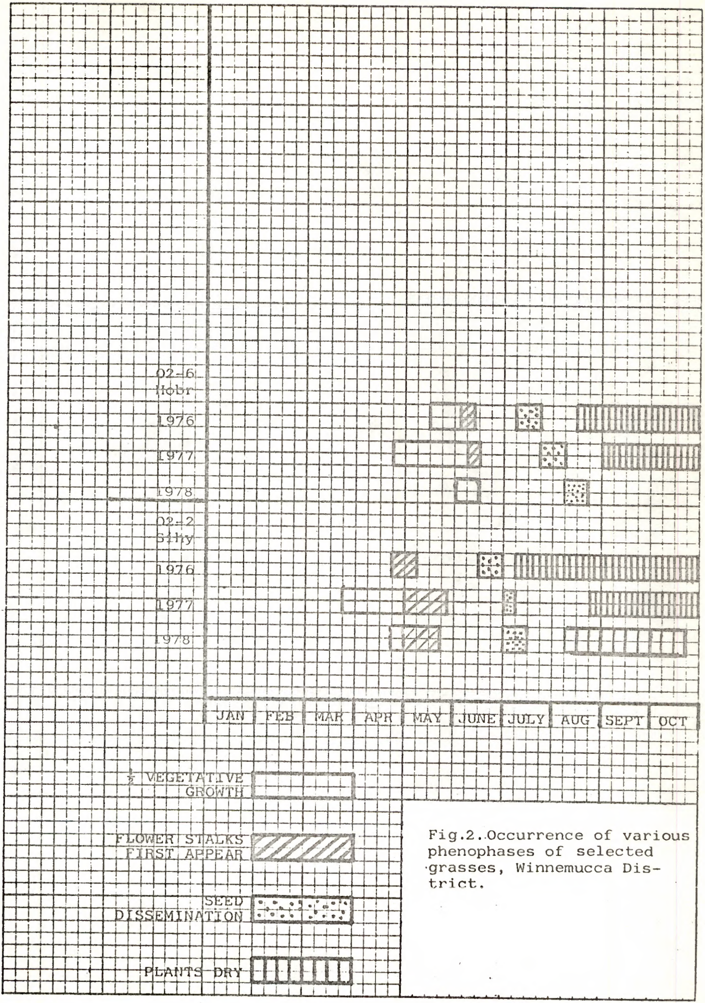

Fig.2. Occurrence of various phenophases of selected grasses, Winnemucca District.

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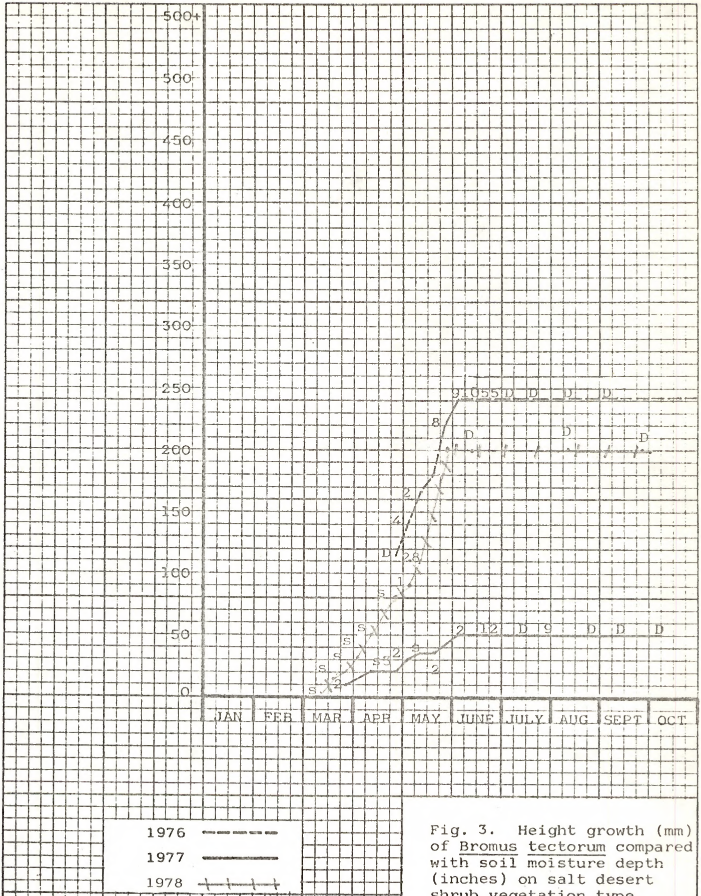

Fig. 3. Height growth (mm) of Bromus tectorum compared with soil moisture depth (inches) on salt desert shrub vegetation type (site 02-2), Winnemucca District.

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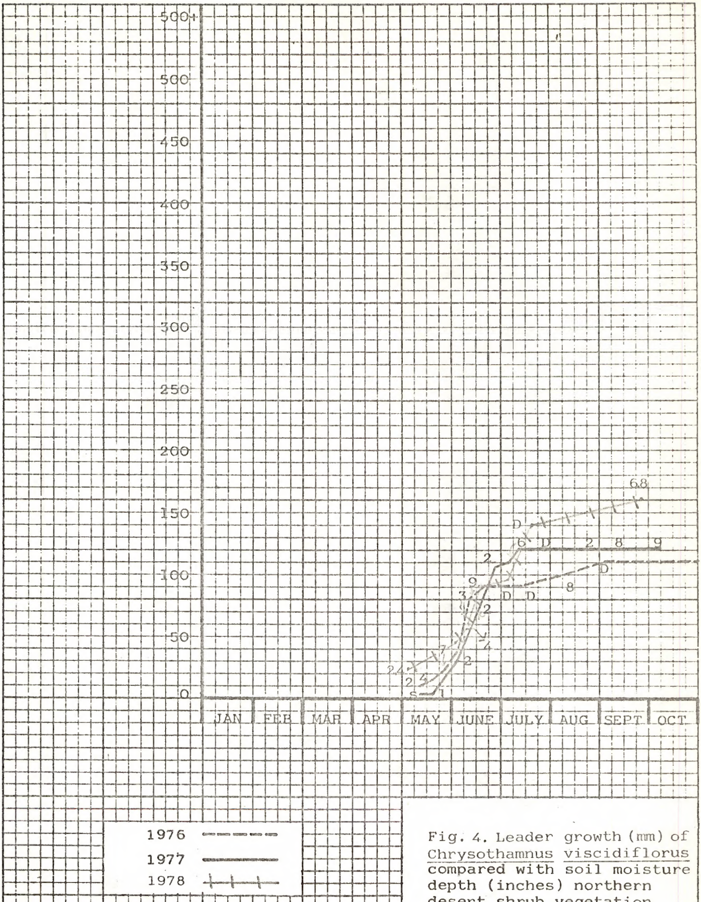

Fig. 4. Leader growth (mm) of Chrysothamnus viscidiflorus compared with soil moisture depth (inches) northern desert shrub vegetation type (site 02-3-2), Winnemucca District.

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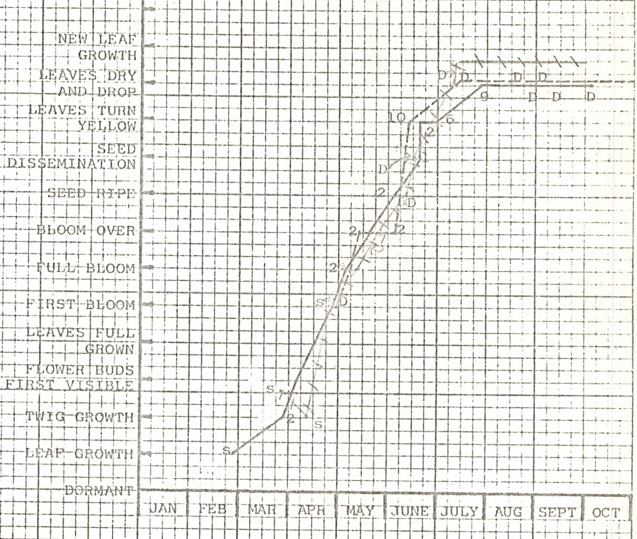

Fig. 5. Phenology of *Artemisia spinescens* compared with soil moisture depth (inches) on salt desert shrub vegetation type (site 02-2), Winnemucca District.

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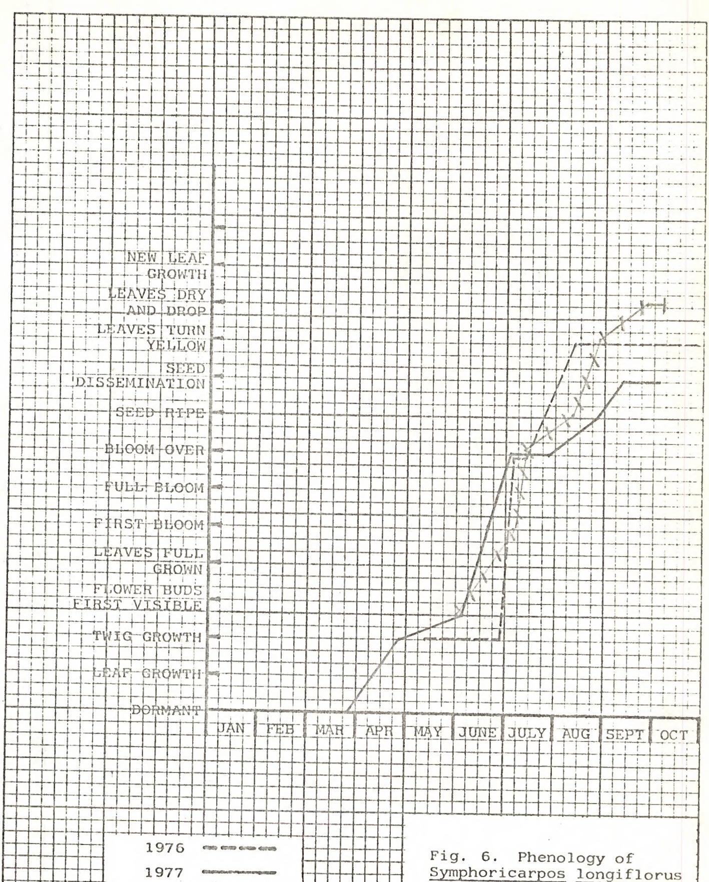

Fig. 6. Phenology of Symphoricarpos longiflorus in mountain brush vegetation type (site 02-7), Winnemucca District.

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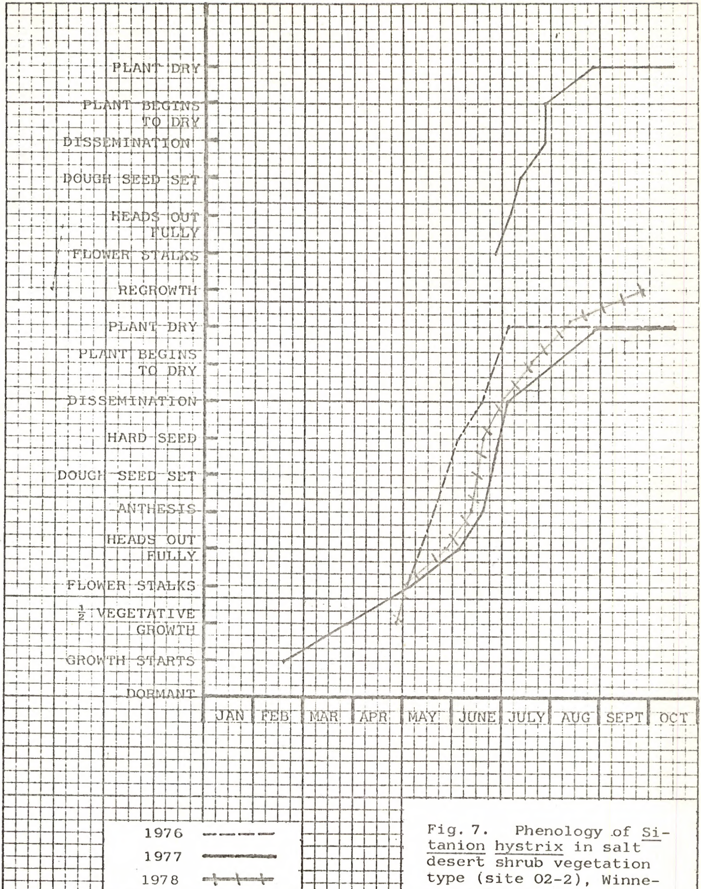


Fig. 7. Phenology of Sitanion hystrix in salt desert shrub vegetation type (site 02-2), Winnemucca District.

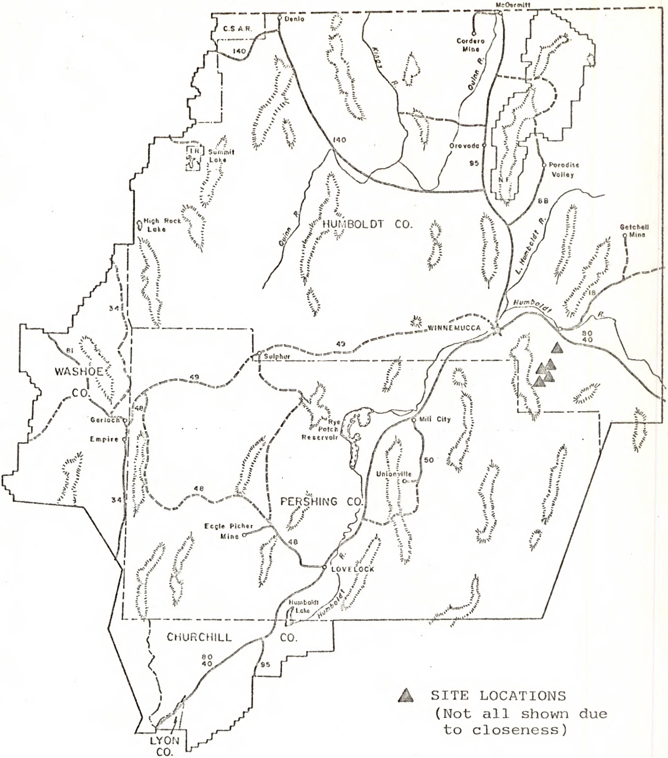
Table 1. Leader (Shrubs) and Height (Grasses) Growth in Winnemucca District for 1976, 1977, and 1978.

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 02-2						
SHRUBS						
1. Grsp	70		45		♀ 70 ♂ 55	
2. Arsp	25		15		30	
3. Atco	80		53		85	
GRASSES						
1. Brte	240		50		200	
2. Sihy	240		135		270	50
3. Posa	300		110		260	20
FORBS						
1. Lepe	180		150		200	
Site 02-3-1						
SHRUBS						
1. Arar	70		15		180	
2. Artr	45		27		230	
3. Tegl			60		100	
4. Chna			110		130	
GRASSES						
1. Agsp	600		330		350	30
2. Posa	200		63		280	15
3. Sihy	300		200		230	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
02-3-1 Con't.						
4. Brte	200	80	90		190	10
5. Stth			80		200	10
FORBS						
1. Luca	180		55		300	
2. Crac	190		160		120	
3. Phho	50		6		100	
4. Casti sp.	200		180		180	
5. Astra sp.			65		50	
Site 02-3-2						
SHRUBS						
1. Chvi	110		120		160	
2. Tegl	70		65		100	
3. Atco			50		110	
4. Arsp			15		30	
5. Artr			20		220	
GRASSES						
1. Posa			30	70	280	20
2. Sihy			165		260	40
3. Brte			20	70	180	30
FORBS						
1. Phho	50		2		40	
Site 02-6						
SHRUBS						
1. Salix sp.	140		155		110	

	Millimeters			
	1976 Regrowth	1977 Regrowth	1978 Regrowth	
02-6 Con't.				
GRASSES				
1. Pobu	250	55	340	
2. Hobr	450	100	500	
3. Juncu sp.	400	300	300	
4. Carex sp.	120	100	160	
FORBS				
1. Taof	85	75	150	
2. Iris sp.	500	450	400	
3. Acla	300	290	340	
4. Veca	1000	650	600	
5. Cirsi sp.		460	400	
Site 02-7				
SHRUBS				
1. Amal	45	9	30	
2. Arar	170	15	140	
3. Sylo	70	130	80	
4. Hodi	60	73	85	
GRASSES				
1. Agsp	610	400	500	
2. Elci	1200	88-	1220	
3. Posa	400	75	270	20
FORBS				
1. Pesi	60		70	
2. Phho	40	14	80	
3. Luca	400	250	360	

	Millimeters			
	1976 Regrowth	1977 Regrowth	1978 Regrowth	
02-7 Con't.				
4. Zigad sp.		250	250	
5. Haplo sp.		12	60	
Site 02-11				
SHRUBS				
1. Riau	90	105	180	
2. Rowo	110	63	100	
3. Artr	120	50	280	
4. Prvi	160	120	120	
5. Chna		185	180	
6. Salix sp.		210	120	
7. Potr		90	260	
GRASSES				
1. Posa	310	97	280	20
2. Pobu	330	125	400	
3. Elci		700	990	
4. Brte		180	200	30
5. Carex sp.		85	130	
FORBS				
1. Erci	60	80	80	
2. Cirsi sp.		580	140	
3. Arlu		400	370	
4. Iris sp.		480	580	



▲ SITE LOCATIONS
(Not all shown due
to closeness)

WINNEMUCCA DISTRICT

SYMBOL 1978	24 FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)	S 30	- 30	S 30	S 30	S 30	S 30	S 30	-	S 30	25 30	76 30	-	18 30	-	D	D	-	D	-	D	-	-	D	-	D	-	-	-	25 30						
Precip.(mm)							18		21	5	.1		11		4	3		7		19			0		0				51						
S.T.(^oC) Max Min							27 2		29 2	27 3	23 5		25 8		27 10	34 15		41 12		34 15			38 16		38 16				20 9						
Winn. 02-2																																			
SHRUBS																																			
Atco	D				LG				TG BV	FG	1B		FB		SR	SD				LY					LD				D						
Arsp	LG				BV		TG BV		1B		FB		BO		SR	SD		LD											D						
Grsp ♀	D				LG	BV TG			BV		1B		BO		SD	SD		LD											D						
♂	D				LG	TG			1B		1B		BO		SR	LY		LD											D						
GRASSES																																			
Sihy	GS								½V	FS			HO		An	HS		SD		BD			PD						GS						
Posa						½V	FS		HO				An		DS	SD		BD		PD									GS						
Brte					GS				½V	FS	HO		DS			SD		BD					PD						D						
FORBS																																			
Lepe	D								1B		FB		SR			BD		PD											D						

SYMBOL 1978	24 FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)	S 30		S 30	S 30			S 30			5 30	2 30			5 30	7 30	17 30		S 30		7 30			21 30		27 30				20 30						
Precip.(mm)							24		36	9	.3			11	1	114		16		.5			.14		0				57						
S.T.(°C) Max							25		27	27	18			21	29	30		29		33			38		38				27						
Min							-2		-4	-6	6			12	9	11		11		18			17		17				7						
Winnemucca 02-3-1																																			
SHRUBS																																			
Artr	D						LG		TG					BV									FG						1B						
Arar	D								TG					BV									FG						1B						
Tegl	D				LG				BV					TG FG				FB		SR			SD		LY				LD						
Chna	D				LG										TG								BV		FG				SD						
GRASSES																																			
Agsp	D		GS						½V						FS					HO					BD				PD GS						
Sihy	GS								½V		FS				HO	An		DS		HS			SD		PD										
Posa	GS						FS		HO					AN	DS	SD		BD		PD									GS						
Brte	D				GS				½V	FS				An		DS		BD		PD									GS						
Stth	D		GS							½V				FS		HO		HS		SD			BD		PI				GS						
FORBS																																			
Phho	D			GS			FS		1B		FB			BO	SR	DS		BD		PD									D						
Crac	D				GS						FS					FB		DS		BD			PD						D						
Casti sp.	D					GS			1B		FB					BO		SR		DS			PD						D						

SYMBOL 1978	FEB 24	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
innemucca 2-3-1 con't																																		
ORBS																																		
uca	D				GS				FS	1B	FB					SR		DS		BD			PD						D					
stra sp.	D				GS		FS		1B		FB				SR	DS		PD											D					

SYMBOL 1978	24 FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD (From-To in cm)	S 30		S 30	S 30	2 30	S 30	S 30		S 30	S 30	5 30			10 45	12 30	27 30		D		D			D		D				17 30						
Precip. (mm)							21		28	6	.3			.4	2	.12		7.6		0			0		0				55						
S.T. (°C) Max Min							24 -2		26 -2	24 -4	23 3			26 7	37 10	38 15		30 12		31 15					38 16										
Winnemucca 02-3-2																																			
SHRUBS																																			
Atco	D					TG			BV					FG	1 B	FB		BO		SR					SD				LY						
Arsp	LG					BV	TG BV			1B				FB	BO	SD		LD											D						
Artr	D					LG			TG	BV													FG		1B										
Tegl	D				LG	TG	BV							FG		1B		FB		SR			SD		LY				LD						
Chvi	D					LG				TG								BV					FG		FB				SD						
GRASSES																																			
Posa	GS					$\frac{1}{2}$V	FS		HO					An	DS	HS		BD		PD									GS						
Sihy	GS						$\frac{1}{2}$V			FS				HO	An	DS		HS		SD			PD						GS						
Brte	D				GS				FS		HO			A n	DS	HS		BD					PD						GS						
FORBS																																			
Phho	D			GS	FS		1B		FB						BO	DS		BD		PD									D						

SYMBOL 1978		MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)														S 45	S 45	S 30		S 30		S 30			S 30		S 30				S 30						
Precip.(mm)																									0				55						
S.T.-(°C)																																			
Winnemucca 02-6																																			
SHRUBS			SNOW				SNOW				SNOW																								
Salix sp.														SR		SD				LY									LD						
GRASSES																																			
Pobu														HO	An	DS		SD		BD					PD				D						
Carex sp.														HO				An		DS			SD						BD						
Hobr														$\frac{1}{2}$V		HO		An		DS			SD		BD				D						
Juncu sp.														$\frac{1}{2}$V	FS	HO		DS		HS			SD						BD						
FORBS																																			
Taof														FB				DS		PD					D										
Iris sp.														GS	FS	FB		BO		SR					BD				PD						
Acla														FS		1B		FB					BO		DS				PD						
Cirsi sp.														GS		FS		1B		FB			SR		BD				PD						
Veca														GS						gr.			BD		PD										

SYMBOL 1978		MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD (From-To in cm)														S 45	5 45	S 30		S 30		24 30			29 30		D										
Precip. (mm)																15		17		0			1						55						
S.T. (^oC)																																			
Winnemucca 02-7																																			
SHRUBS		SNOW				SNOW				SNOW																									
Amal														1B	FB	BO		SR		SD LY			LY						LD						
Sylo														BV				1B		BO			SR		LY				D						
Hodi														BV				1B		BO			SR		LY				LD						
Arar														TG						BV					FG				1B						
GRASSES																																			
Agsp														½V	FS					DS			HS		BD				PD						
Elci														½V	FS	HO		An		DS			HS		SD				BD						
Posa														An		DS		SD					BD		PD				GS						
Sihy														FS		An		DS		HS			SD		PD				GS						
FORBS																																			
Phho														FB		SR		BD		PD					D										
Luca														1B				BO		DS			BD		PD				D						
Pesi														1B		BO				SR			DS		BD				PD						
Zigad sp.														FS	1B	FB		SR		BD			PD		D										

SYMBOL 1978		MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
Winnemucca 02-7 con't																																		
FORBS		SNOW				SNOW				SNOW																								
Haplo sp.														FS	1B	FB		SR		BD			PD		D									

SYMBOL 1978	24 FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)	S 30		S 30	S 30	S 30	S 30	S 30		S 30	S 30	5 30			2 30	5 30	20 30		S 30		10 30			20 30		D				17 30						
Precip.(mm)							23			7.6	.3			12	.4	5		10		0			1		0										
S.T.(°C) Max. Min.							22 0		22 -1	27 -4	22 5			26 7	28 9	33 10		29 12		38 18			38 17		38 12				22 5						
Winnemucca 02-11																																			
SHRUBS																																			
Salix sp.	D					LG					TG BV			BO	SR	SD		LY																	
Prvi	D				LG				BV	TG BV				1B	FB	BO		SR											LY						
Chna	D				LG									TG						BV					FG				1B						
Artr	D					LG			TG					BV											FG				1B						
Potr	D								LG		TG							BV					FG												
Riau	D				LG		BV		TG 1B		FB			BO	SR								SD		LD										
Rowo	D				LG						TG			BV	FG	1B		BO		SR									SD						
GRASSES																																			
Posa	GS					½V	FS		HO					An	DS	HS		BD		PD					D				GS						
Elci	GS								½V		FS					HO		An		DS			HS		BD										
Pobu	D					½V	FS		HO					DS		HS		SD		BD			PD		D										
Brte	D			GS						½V	FS			DS		HS		BD					PD		D				GS						
Carex sp.	D			GS					½V	FS	HO			An		DS		HS							D										

SYMBOL 1978	FEB 24	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
Winnemucca 02-11 con't																																			
FORBS																																			
Erci	GS					FS			1B	FB	BO			SR				DS		PD					D										
Cirsi sp.	D			GS																			PD		D										
Clema sp.	D				GS					FS								1B		BO			DS		BD										
Arlu	D				GS						FS							1B					BO		DS				BD						
Iris sp.	D				GS					FS				1B	FB	BO		SR					DS		BD				PD						

CARSON CITY

Data from the Carson City sites is similar to other locations relative to pattern correlations and general relationships. No outstanding anomalies are presented. The heading-out of grasses seems to be closely correlated with May precipitation and an onset of somewhat warmer temperatures in June. Also, vegetative growth of grasses appears to be strongly regulated by soil temperature when moisture is adequate.

An examination of leader and height growth (grasses and forbs) indicates that, overall, 1978 was a somewhat better growth year on many sites than either 1976 or 1977 (Table 1). However, not all species or sites show this trend. A quantitative analysis will be required before the strength of such relationships can be proven.

The three-year comparison for leader growth on big sagebrush (_Artemisia_ _tridentata_; Figure 1) shows relative similarity among years with drying occurring two or three weeks earlier in 1978. Height growth of Indian ricegrass (_Oryzopsis_ _hymenoides_; Figure 2) shows much greater variation with 1977 exhibiting remarkably greater growth than either 1976 or 1978. This phenomena is quite possibly a direct result of differing soil moisture depths for each of the three years.

The phenology of desert globemallow (_Sphaeralcea_ _ambigua_; Figure 3) was quite similar in 1976 and 1977, but developed faster in 1978, with most phenophases occurring two to four weeks earlier. Indian ricegrass development occurred early in 1978 and late in 1977 (Figure 4). The late development in 1977 occurred when the soil moisture depth was relatively deep (or dry) in April and May. A very similar pattern is shown for squirreltail grass (Sitanion hystrix; Figure 5).

Leaf growth of bitterbrush (Purshia tridentata) was evident in 1978, but not in the previous two years (Figure 6). The initiation of twig growth varied considerably from year to year for both bitterbrush and low sagebrush (Artemisia arbuscula) - black sagebrush (Artemisia nova). Seed dissemination varied more in Indian ricegrass than in Kentucky bluegrass (Poa pratensis; Figure 7). The onset of growth in arrowleaf balsamroot (Balsamorhiza sagittata) began earlier each progressive year for the three years (Figure 8).

Figure 9 shows a two year comparison for squirreltail grass as it developed on three sites. There appears to be slightly more variation from site to site in 1978. In 1977, the development of this species was very close. The growth of flower stalks and headings occured in a very narrow time frame for both years and all three sites.

EUGENE DIETZGEN CO.
MADE IN U. S. A.

NO. 340 - DIETZGEN GRAPH PAPER
8 X 8 PER INCH

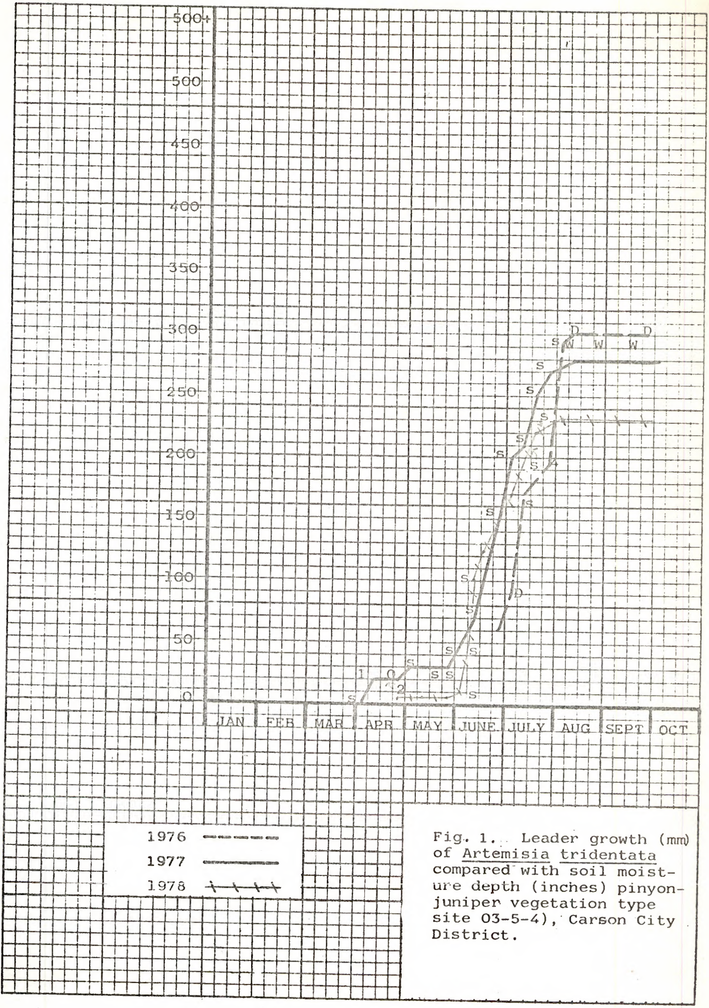


Fig. 1. Leader growth (mm) of Artemisia tridentata compared with soil moisture depth (inches) pinyon-juniper vegetation type site 03-5-4), Carson City District.

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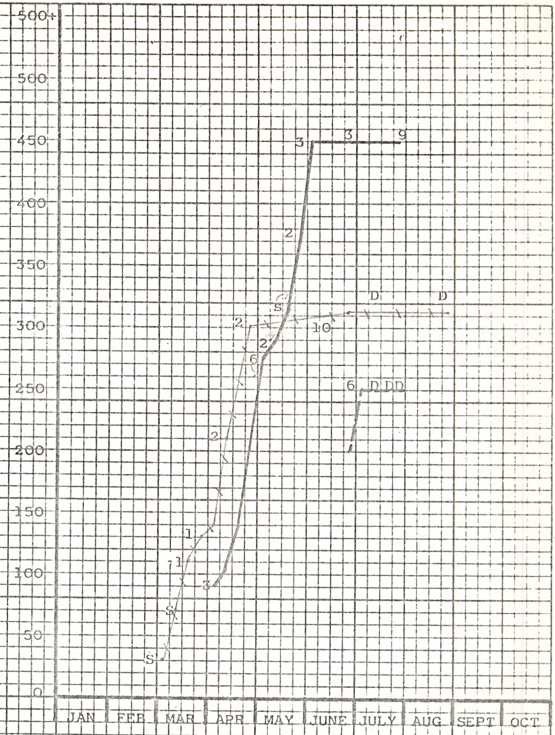

Fig. 2. Height growth (mm) of *Oryzopsis hymenoides* compared with soil moisture depth (inches) on northern desert shrub vegetation type (site 03-3-1), Carson Ctiy District.

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GENE DIETZGEN C.
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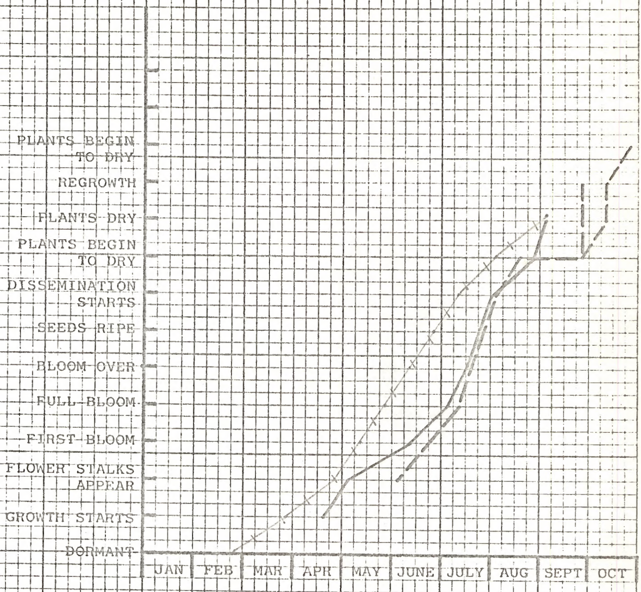

Fig. 3. Phenology of Sphaeralcea ambigua on salt desert shrub vegetation type (site 03-2-1), Carson City District.

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NO. 340-B DIETZGEN GRAPH PAPER
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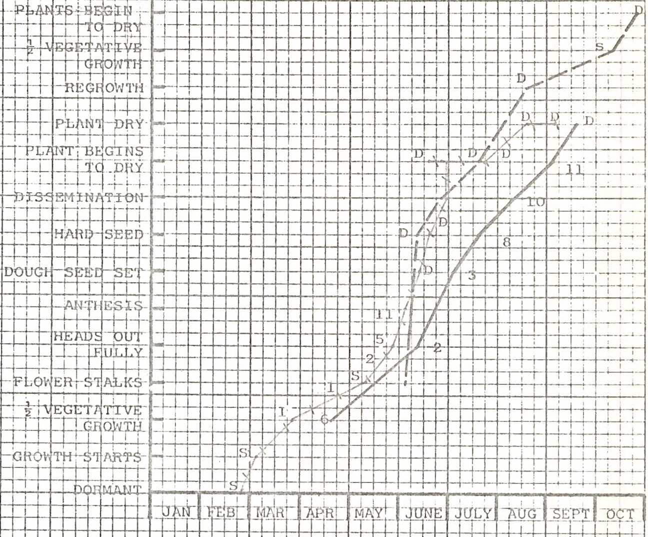

Fig. 4. Phenology of *Oryzopsis hymenoides* compared with soil moisture depth (inches) on salt desert shrub vegetation type (site 03-2-1), Carson City District.

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MADE IN U.S.

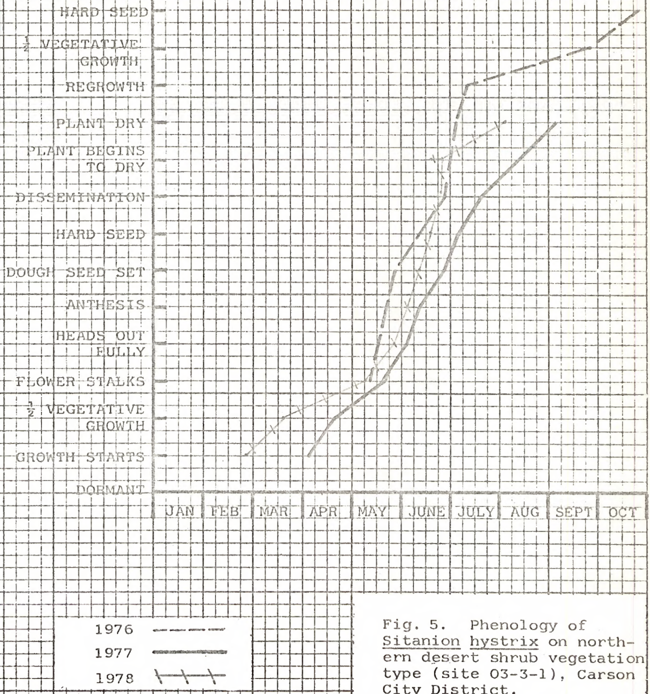

Fig. 5. Phenology of Sitanion hystrix on northern desert shrub vegetation type (site 03-3-1), Carson City District.

EUGENE DIETZGEN CO.
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NO. 340-B DIETZGEN GRAPH PAPER
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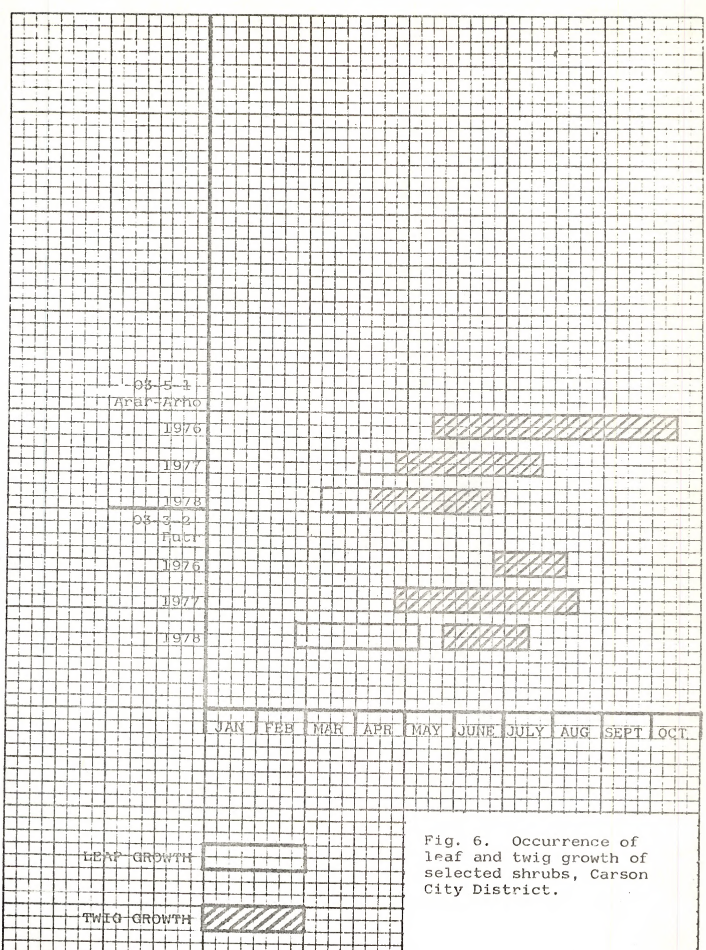

Fig. 6. Occurrence of leaf and twig growth of selected shrubs, Carson City District.

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NO. 340-8 DIETZGEN GRAPH PAPER
8 X 8 PER INCH

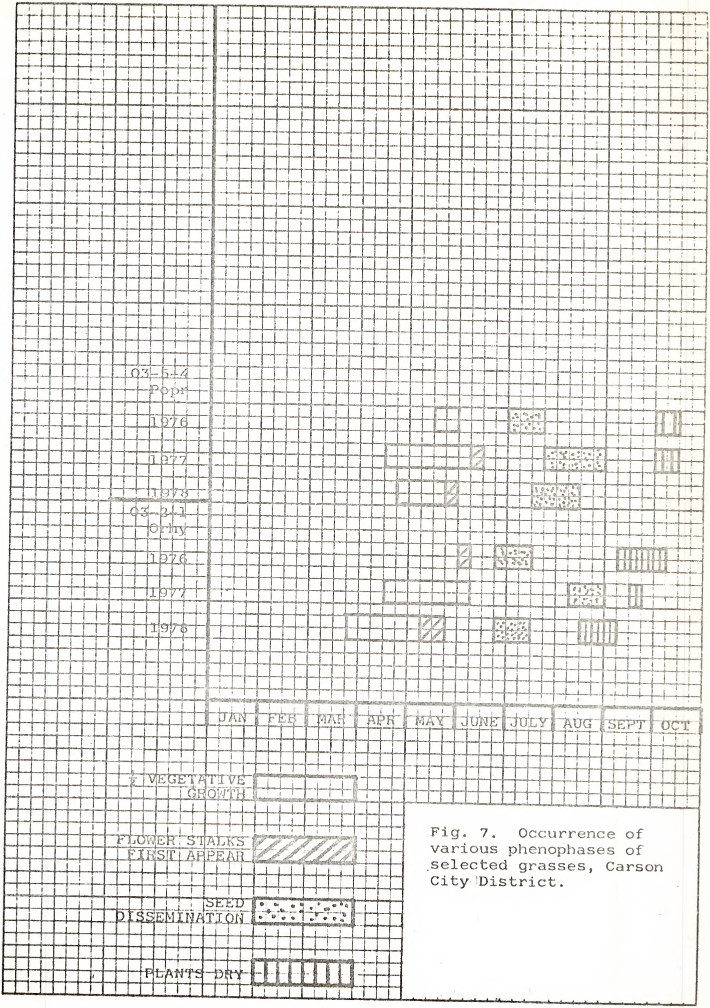

Fig. 7. Occurrence of various phenophases of selected grasses, Carson City District.

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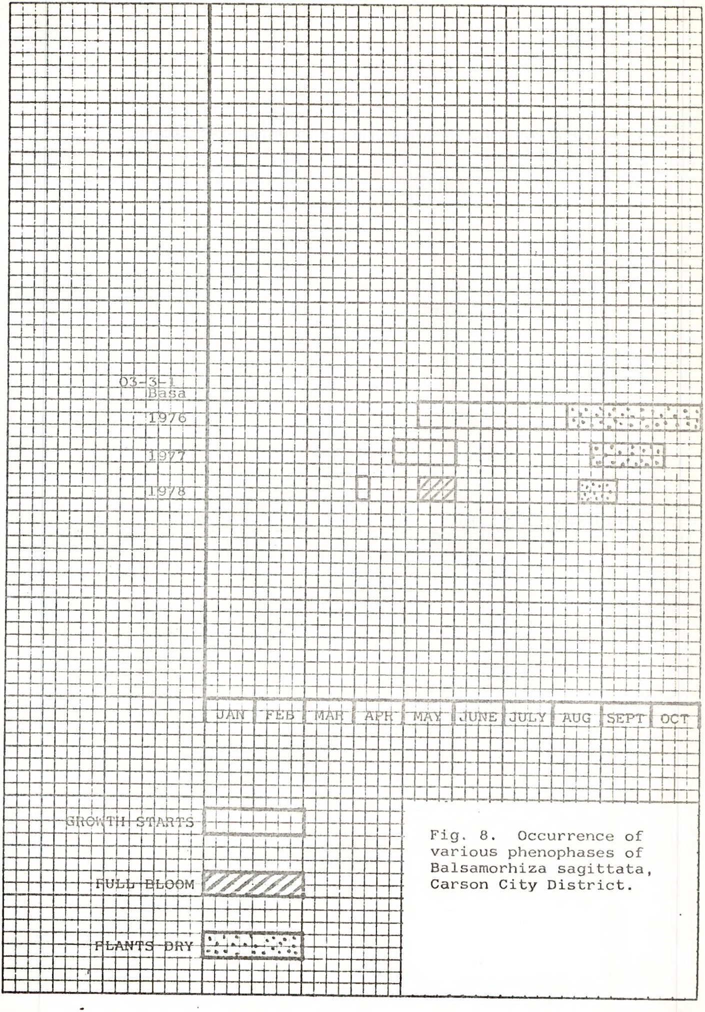

Fig. 8. Occurrence of various phenophases of Balsamorhiza sagittata, Carson City District.

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8 X 8 PER INCH
EUGENE DIETZGEN CO.
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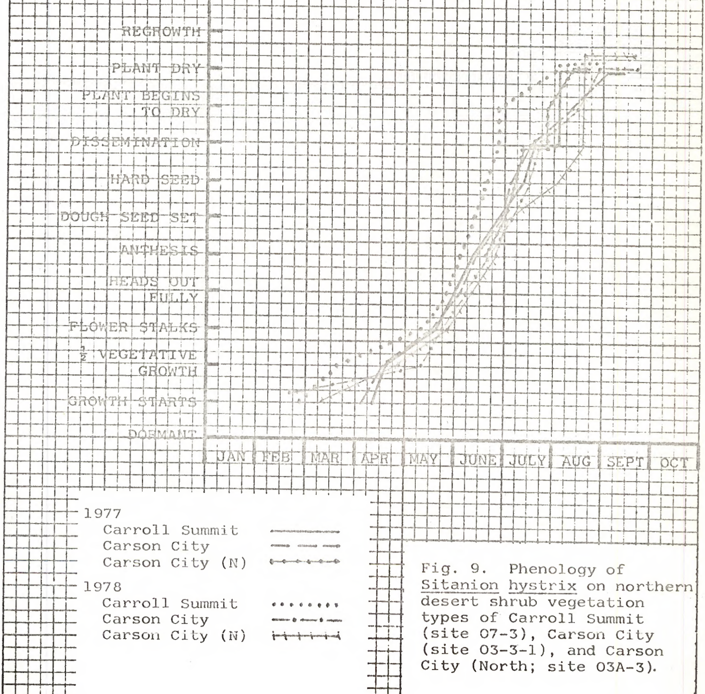


Fig. 9. Phenology of Sitanion hystrix on northern desert shrub vegetation types of Carroll Summit (site 07-3), Carson City (site 03-3-1), and Carson City (North; site 03A-3).

Table 1. Leader (Shrubs) and Height (Grasses) Growth in the Carson City District for 1976, 1977, and 1978.

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 03-2-1						
SHRUBS						
1. Cela	70		80		125	
2. Artr	90		120		160	
3. Atca	118		70		85	
4. Tegl	120				90	
5. Chvi	71		100		105	
6. Atco	32		70		105	
7. Epne	240		80		0	
8. Chna	55		120		160	
9. Arsp			10		30	
10. Grsp			30		90	
GRASSES						
1. Orhy	190	150	290		310	
2. Sihy	250	100	270		215	
3. Stipa sp.					290	
FORBS						
1. Astra sp.	85		110		not found	
2. Spam	100		275		230	
Site 03-3-1						
SHRUBS						
1. Grsp	40		160		180	

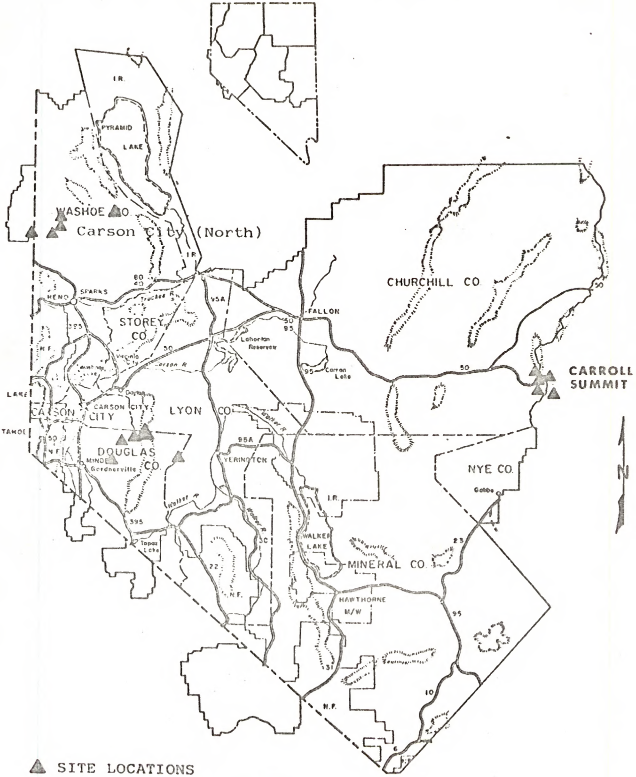
	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
03-3-1 Con't.						
2. Pran	120		50		120	
3. Artr	80		190		210	
4. Chvi	50		145		145	
5. Chna	35		140		150	
6. Epvi	110		75		90	
7. Lepu	80				180	
8. Teca			100		140	
9. Saca			110		70	
GRASSES						
1. Orhy	250		450		310	
2. Brte	120		140		140	
3. Sihy	130		250		245	
4. Stco			180		290	
FORBS						
1. Basa	200		250		250	
Site 03-3-2						
SHRUBS						
1. Artr	115		160		180	
2. Epne	100		115		100	
3. Putr	30		120		130	
4. Pran	35		70		90	
GRASSES						
1. Stth					230	
2. Sihy	90		195		210	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
03-3-2 Con't.						
3. Orhy	170		185		140	
4. Stco			140		140	
Site 03-5-1						
SHRUBS						
1. Arno-Arar	15		105		140	
2. Tegl	75				55	
3. Chna			145		140	
4. Grsp					90	
GRASSES						
1. Brte	90		90		100	
2. Sihy	109		160		240	
3. Stipa sp.			100		175	
4. Posa					80	
FORBS						
1. Erci			100		150	
Site 03-5-2						
SHRUBS						
1. Artr	220		220		280	
2. Pran	16		45		150	
3. Putr	25		70		170	
4. Chna	120		115		150	
5. Ribes sp.	100				50	
6. Symph sp.	70		100		90	
7. Tegl			100		140	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
03-5-2 Con't.						
GRASSES						
1. Elci	850	335	680		800	
2. Posa	32	70	160		150	
3. Sihy	290	85	320		270	
4. Stth					310	
FORBS						
1. Senec sp.			150		180	
Site 03-5-4						
SHRUBS						
1. Artr	300		280		230	
2. Chna	120		170		150	
3. Ribes sp.	15		105		80	
4. Rowo	130		160		65	
GRASSES						
1. Popr	690		495		300	
2. Juncu sp.	610		500		550	
3. Carex sp.	370		175		160	
4. Agrop sp.			520		670	
5. Pobu			250		260	
6. Agcr			440		600	
FORBS						
1. Poten sp.					380	
2. Taof	205		140		120	
3. Veth	640		1020		750	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
03-5-4 Con't.						
4. Acmi			380		550	
Site 03-7-1						
SHRUBS						
1. Putr	260		250		55	
2. Ribes sp.	100		125		60	
3. Syal	500		140		80	
4. Artr	300		220		170	
GRASSES						
1. Posa	70	100	185		130 (grazed)	
2. Brte	170		160		grazed	
3. Brca			375		200 (grazed)	
FORBS						
1. Alliu sp.			180		175 (grazed)	
Site 03-7-3						
SHRUBS						
1. Artr	290		340		300	
2. Pran	32		160		180	
3. Ribes sp.	14		170		90	
4. Teca					130	
5. Putr	75		135		140	
6. Chna	250		160		140	
7. Epvi	100		260		100	
GRASSES						
1. Agcr	485	165	500		450	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
03-7-3 Con't.						
2. Sihy	300	110	315		220	
3. Orhy	400	106	425		400	
4. Agtr	671		600		400	
5. Brte	265	80	210		100	
FORBS						
1. Circi sp.			450		600	
2. Lysp			305		200	



▲ SITE LOCATIONS
(Not all sites shown due
to closeness)

CARSON CITY DISTRICT

SYMBOL 1978	FEB 23	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)	S	S	S	4	4	1	4		S 30	21 30	5 30	11 30	13 30	29	D	D	D	D	D	D		D		D		D									
Precip.(mm)							0		12	12	0	0	0	0	0	0	0	0	3	0		0		0		0									
S.T.-°C				17	16	10	15		10	13	15	16	21	22	25	21	25	26	23	27		29		25		25									
arson City 3-2-1					–																														
HRUBS																																			
ela	D			LG			TG					BV	1B	FB	SR				SD			LY		LD											
rsp	LG		BV				TG		1B		FB		BO		SD	SD LY				LY		LD													
tca	LG												TG		1B	FB			BO	SR															
hvi	LG						TG							BV						1B				FB		BO									
tco ♀	LG						TG							FB	1B	FB			BO	SR				SD											
♂	LG						TG							FG					BO	–				–											
Tegl	LG								TG		BV			1B	FB				SR	SD		SD LY		LY											
pne	D						BV						FB			BO			SD					LY											
Artr	LG								TG				BV																						
Grsp ♀	LG		BV				TG TB		BO	SR					SD	–		–	SD LY	LY				LD											
♂	LG		BV				TG 1B		FB	BO					–	SR		SD	SD LY	LY				LD											
Chna	D			LG							TG					BV																			

SYMBOL 1978	FEB 23	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
SMD (From-To in cm)																																		
Precip. (mm)																																		
S.T.-°C																																		
Carson City 03-2-1 con't																																		
GRASSES																																		
Orhy	D	GS			½V						FS		HO	An	DS	HS BD	SD BD			BD				PD										
Sihy	GS				½V						FS		HO	An	DS	HS BD	SD BD							PD										
Stipa sp	GS				½V						FS		HO	DS	HS	HS BD		SD BD						PD										
FORBS																																		
Spam	D				GS				FS		1B		FB		BO		SR		DS					PD										

SYMBOL 1978	FEB 23	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
SMD(From-To in cm)	S	S	S	4	3		5 30		5 30	S 30	7 30	11 30	11 30	13 30	15 30	25 40			14 30	D		D		D		D								
Precip.(mm)							0		10	6	0	1	1	1	1	1	1	0	4	0		0		3		0								
S.T.-°C				19	15	11	12		13	12	16	16	22	25	21	25	25	26	26	27		29		28		27								
Carson City 03-3-1					-																													
SHRUBS																																		
Chvi	LG					TG												BV						1B		FB								
Grsp	D	LG		BV		TG			BO	SR		-			SD	-				SD LY		LY		LD										
	D	LG		BV		TG FG			FB	-		BO			-	SD				LY		LY		LD										
Epvi	D					BV						FB	BD					SR	SD															
Artr	D	LG							TG								BV																	
Chna	D		LG										TG					BV																
Teca	D	LG							TG							BV		1B	FB			BO SR		SD										
Pran	D			LG			BV		1B		FB	BO		TG	FG	SR		SD	SD LY			LY												
Lepu	LG					TG							BV	1B	FB		BO	SR				SD		LY										
Saca	D						LG				TG		BV	FB				BO				SD		LY		LD								
GRASSES																																		
Sihy	GS			½V							FS		HO	An	DS	HS BD	SD BD					PD												

SYMBOL 1978	FEB 23	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
SMD(From-To in cm)																																		
Precip.(mm)																																		
S.T.-°C																																		
Carson City 03-3-1 con't																																		
GRASSES																																		
Orhy	D	GS			½V		FS							HO	DS	HS BD	SD BD					BD												
Brte	D			GS							FS	HO	An	DS	HS	SD BD					PD													
Stco	D	GS				½V					FS		HO	An	DS		HS	SD BD			BD			PD										
FORBS																																		
Basa	D					GS	FS		1B		FB			BO	SR			DS			DS BD	BD		PD										

SYMBOL 1978	FEB 23	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)	S			3	4	2	S 30		S 30	S 30	4 30	7 30	11 30	15 30	20 30	D	D	D	D	D		D		D		D									
Precip.(mm)							0				0	0	0	1	1	0	0	0	1	0		0		0		0									
S.T.-°C				15	17	9	14		11	13	18	15	20	22	23	22	23	25	25	26		28		26		25									
Carson City 03-3-2																																			
SHRUBS																																			
Artr	D			LG					TG								BV																		
Epne	D												BV	FB	TG BO			SR				SR		LY											
Pran	D			LG		BV			FG 1B	FB			BO	SR				SD								LY									
Putr	LG										1B	BO	TG	FG		SR					SD					LY									
GRASSES																																			
Orhy	D			GS		½V							FS	HO	DS		HS	SD			BD			PD											
Sihy	GS				½V							FS	HO	An	HS	HS BD		SD BD				BD		PD											
Stth	GS					½V						FS	HO	An	HS		HS BD	SD				BD		PD											
Stco														An	DS	HS	BD	SD BD				BD		PD											
FORBS																																			

SYMBOL 1978	FEB 23	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
SMD(From-To in cm)	S	S	S	5	4	1	5		8 30	S 30	12 30	12 30	12 30	14 30	16 30	21 30	23 30	27 45	23 30	D		D		D		D								
Precip.(mm)							0		–	7	0	3	1	1	1	1	1	0	3	0		0		8		0								
S.T.-°C				18	15	9	11		12	11	16	15	22	23	21	23	23	24	24	30		28		25		25								
Carson City 03-5-1																																		
SHRUBS																																		
Arar-Arno	D		LG				TG										BV	FG																
Chna	D		LG									TG					BV	FG						1B										
Tegl	D	LG							TG	BV				1B	FB		BO LY	BD LD	SD	LD														
Grsp																SD		SD LD			LD													
GRASSES																																		
Sihy	GS			½V							FS		HO	An	DS	HS BD		SD PD				PD												
Brte	D	GS							½V		FS		HO	An	DS	HS BD	SD BD	SD PD			PD													
Stipa sp.	GS					½V			FS				An	DS	HS		HS BD	SD PD			PD													
Posa											An		DS	HS	SD BD			SD PD			PD													
FORBS																																		
Erci	GS						1B				FB	BD	SR	BD	PD																			

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
SMD(From-To in cm)					S	S	1		S 30	S 30	S 30	5 30	5 30	6 30	7 30	25 45	26 45	29 45	20 45	D		D		D		D								
Precip.(mm)							0		11	20	0	2	2	3	1	2	0	0	6	0		0		0		0								
S.T.-°C		S	N	OW	6	4	6		7	6	8	10	17	19	15	16	18	19	19	20		21		18		20								
Carson City 03-5-2	SNOW																																	
SHRUBS																																		
Putr					LG								BV	FB	BO		TG					SD												
Symph sp.					D				LG			TG			BV		1B	FB	BO			SR				SD LY								
Ribes sp.					LG				BV		FG	1B	FB	BO	FG							SR				SD								
Artr					D	LG					TG							BV																
Chna					LG									TG				BV																
Tegl					D	LG								TG				BV				1B		BO		SD								
Pran					D				LG			BV	FB	BO		TG			SR					SD										
GRASSES																																		
Elci					D		GS						½V			FS	HO				An	DS		HS		SD BD								
Posa					GS								½V			HO	An	HS BD	SD BD	PD														
Sihy					GS								½V	FS		HO	An				HS SD	BD		PD										
Stth																	DS		HS	SD		BD		PD										

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)																																			
Precip.(mm)																																			
S.T.-°C		SN	O	W																															
Carson City 03-5-2 con't																																			
FORBS	SNOW																																		
Senec sp.												1B	FE				BO	BO PD		DS PD		PD													

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
SMD (From-To in cm)										W	E	T		M	E	A	D	O	W															
Precip. (mm)							0		12	15	3	3	1	3	1	1	0	0	4	0		0		1		0								
S.T.-°C						5	9		9	9	12	12	17	19	14	18	24	20	20	22		24		23		21								
Carson City 03-5-4		S	N	O	W																													
SHRUBS																																		
Rowo						LG							TG				1B	FB	BO					SR										
Chna						LG								TG						BV						FG								
Artr						LG			TG									BV																
Ribes sp.						LG	BV				1B	FB	BO	FG				TG						SR										
GRASSES																																		
Popr						GS			½V				FS	HO	An		DS		HS	SD				BD										
Agrop sp.						GS	½V							FS		HO	An			DS		HS		SD										
Pobu						GS			½V		FS	HO	An	DS		HS BD			SD BD			PD												
Juncu sp.						GS	½V								FS		DS					SD												
Agcr						GS			½V					FS			HO		An	DS		HS												
Carex sp.						D					½V				FS	HO	HS		SD BD		PD													
FORBS																																		
Veth						GS														FS		1B		BO										
Poten sp.						GS											FS	1B		FB		BO		DS										

SYMBOL 1978	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
SMD(From-To in cm)										
Precip.(mm)										
S.T.-°C										
Carson City 03-5-4 con't		S N O W								
FORBS										
Acmi			GS		1B	FB		BO		
Taof			GS 1B	FB SR	DS BD		PD			

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)													S 30	S 30	1 30	11 45	11 45	12 45	20 45																
Precip.(mm)														0	0	0	0	0	1																
S.T.-°C		--	--	--	--	S	N	O	W--	--	--	--	9	14	11	11	21	12	12																
Carson City 03-7-1																																			
SHRUBS																																			
Ribes sp.													LG				TG					GRAZED													
Artr													LG	TG					BV																
Putr													LG				BC																		
Syal													LG	TG			BV																		
GRASSES																																			
Brte													D			gr																			
Posa													GS	½V	FS	gr																			
Brca													GS	½V		gr																			
FORBS																																			
Alliu sp.													GS	FS		gr																			

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)						S	2		S 30	S 30	3 30	4 30	7 30	10 30	12 30	25 45	D	D	11 45	D		D		D		D									
Precip.(mm)							0		14	21	0	3	1	1	1	1	00	0	5	0		0		.01		0									
S.T.-°C						4	10		7	8	14	11	15	18	20	17	20	22	24	23		25		21		21									
Carson City 03-7-3		S	N	O	W																														
SHRUBS																																			
Artr						LG			TG									BV																	
Chna						D	LG						TG					BV						1B		FB									
Epvi						D								TG								SD		LY											
Ribes sp.						BV			1B			BO	FG											SD		LY									
Pran						D			BV		FB			BO	TG	SR						SD		LY											
Teca						LG						TG				BV		1B		FB				BO		SB SD									
Putr						LG						TG BV	1B	FB	BO					SR		SD													
GRASSES																																			
Agcr						GS			½V					FS	HO		An			DS		HS SD		SD		SD BD									
Brte						GS						FS		HO	An	DS	HS	SD BD	PD																
Agtr						GS					½V					FS	HO			An		DS		HS		SD BD									
Orhy						GS				½V			FS	HO		An	DS	HS	SD			SD BD		BD											

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)																																			
Precip.(mm)																																			
S.T.-°C																																			
Carson City 03-7-3 con't		S	N	O	W																														
GRASSES																																			
Sihy						GS				$\frac{1}{2}$V			FS	HO	An			DS	HS	SD		BD		PD											
FORBS																																			
Cirsi sp.						D			GS					FS		1B	FB							BO		SR									
Lysp						D					GS						FS			1B		BO		SR		DS									

CARSON CITY (NORTH OF RENO)

CARSON CITY (NORTH OF RENO)

Since these sites were established in 1977, data is compared for 1977 and 1978 only. No extraordinary species differences are seen. Vegetative growth of grasses at site O3A-3 was strongly related to May precipitation and warmer temperatures (annual phenodynamic tables). However, grasses on site O3A-4 and O3A-5 were quite advanced in early April. This followed a period of relatively warm temperature in late March, and soil moisture was probably plentiful. Such site differences may be related to elevation, or just two variable weather patterns in the early spring. A lack of predictability of such site-to-site variations may well reduce the utility of such data. An understanding of the possible magnitude of these variations is valuable.

The phenology of antelope bitterbrush (Purshia tridentata), Indian ricegrass (Oryzopsis hymenoides) and needle-and-thread grass (Stipa comata) shows a similarity of relationships (Figures 1 through 3). The length of the reproductive period (flowering) is of interest. Similar data is presented for squirreltail grass (Sitanion hystrix; Figure 4). With the beginning of growing season missed in 1977, comparisons of the two data sets is difficult for all four of the previous graphs.

Leader growth in antelope bitterbrush (Figure 5) and height growth of Indian ricegrass (Figure 6) shows some interesting differences between the two years. For example, 1978 was a year of early growth compared to 1977.

Figures 7 through 9 show phenophase development for squirreltail grass, antelope bitterbrush, and lupine (*Lupinus caudatus*). Again, the late start of data gathering in 1977 makes analyses difficult. However, some of the later phenophases are of interest. The periods of seed dissemination for squirreltail grass (Figure 7) were identical for both sites on each of the two years. The longer bloom period for tailcup lupine (Figure 9) in 1978 is interesting. Apparently forbs such as lupine can complete the flowering phenophases in a much shorter period during a dry year. This ability, or its lack, would be very influential for the welfare of a species.

Leader and height growth comparison for the two years reveals no clear cut trend (Table 1). Some sites had better growth in 1977, and others had better growth in 1978.

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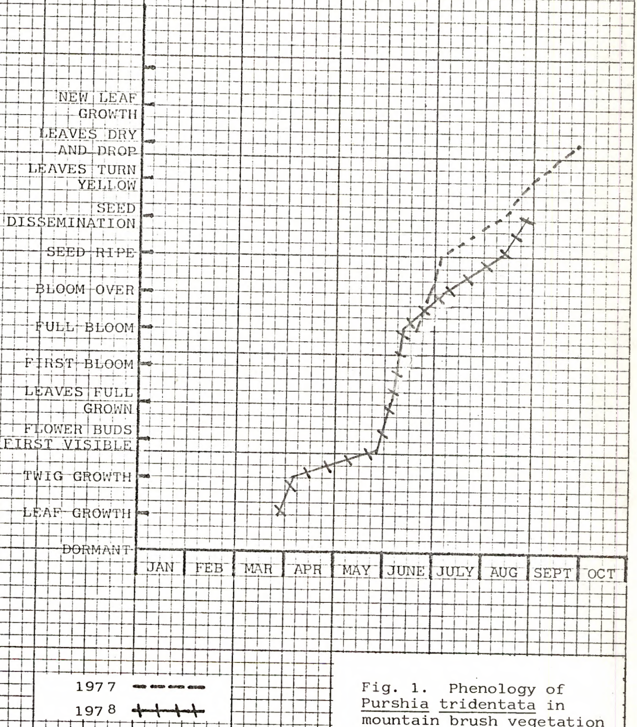

Fig. 1. Phenology of Purshia tridentata in mountain brush vegetation type for Carson City north of Reno (Site 03A-7-2) for 1977 and 1978.

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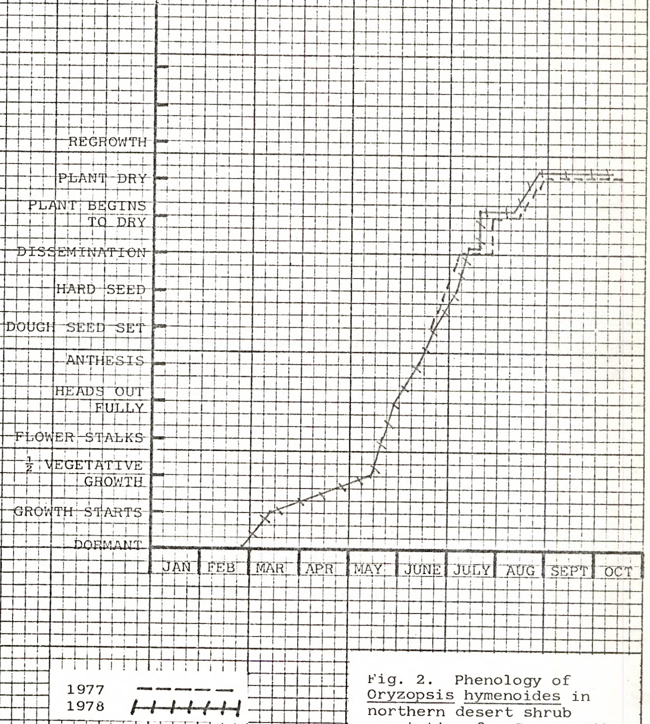

Fig. 2. Phenology of Oryzopsis hymenoides in northern desert shrub vegetation for Carson City north of Reno (Site 03A-3) for 1977 and 1978.

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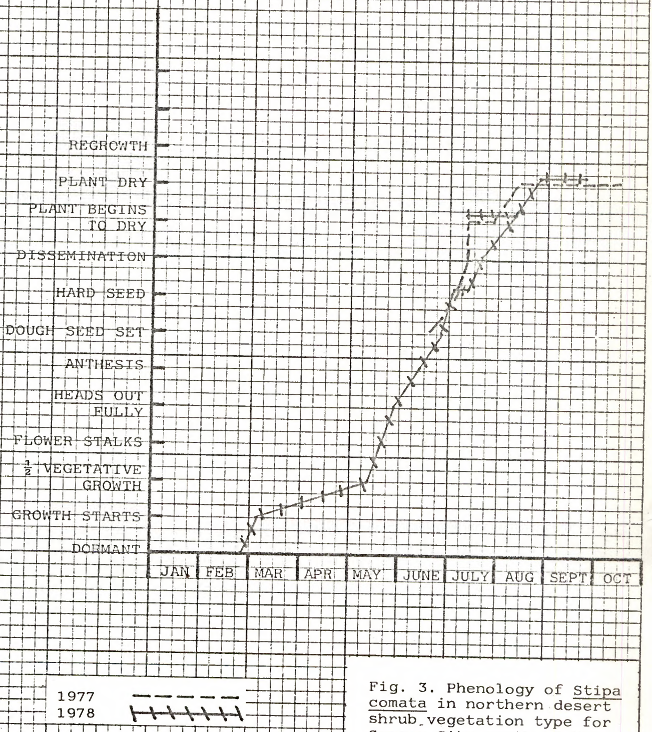

Fig. 3. Phenology of Stipa comata in northern desert shrub vegetation type for Carson City north of Reno (Site 03A-3) for 1977 and 1978.

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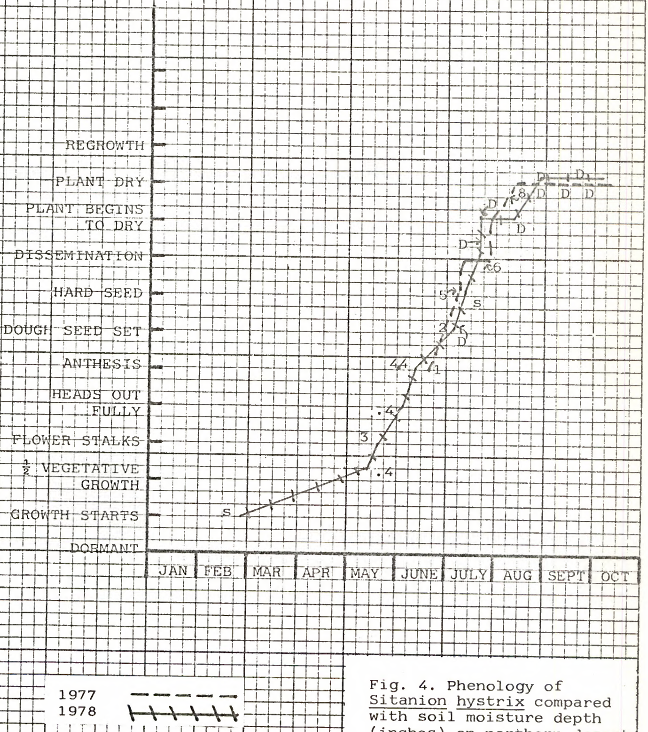

Fig. 4. Phenology of Sitanion hystrix compared with soil moisture depth (inches) on northern desert shrub vegetation type for Carson City north of Reno (Site 03A-3) for 1977 and 1978.

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EUGENE DIETZGEN CO.
MADE IN U. S. A.

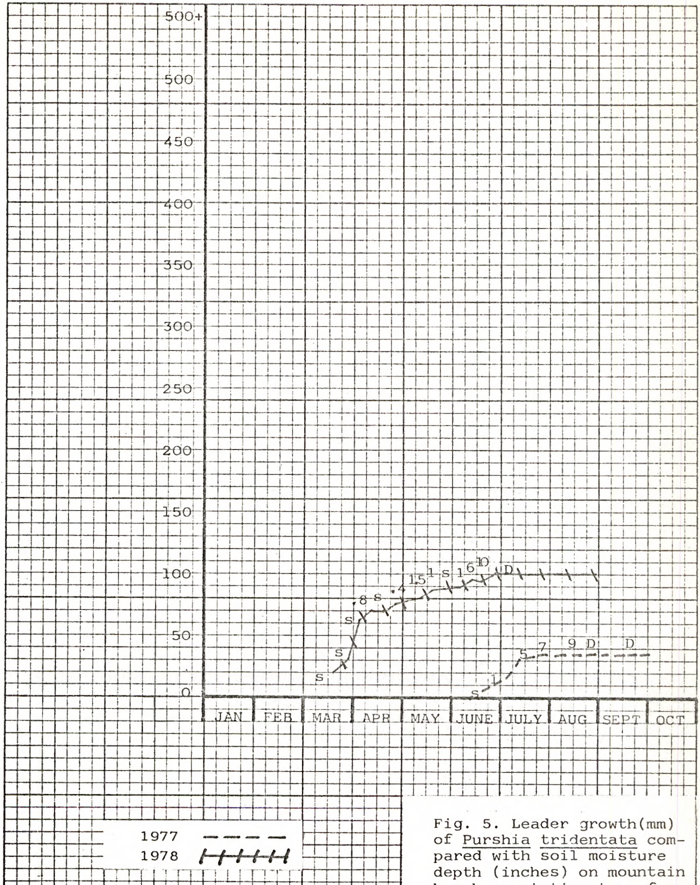

Fig. 5. Leader growth(mm) of Purshia tridentata compared with soil moisture depth (inches) on mountain brush vegetation type for Carson City north of Reno (Site 03A-7-1) for 1977 and 1978.

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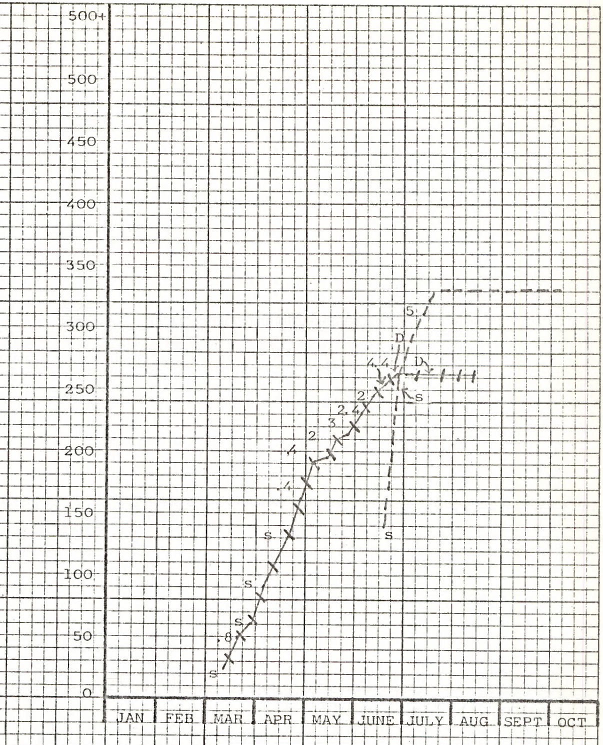

Fig.6. Height growth(mm) of Oryzopsis hymenoides compared with soil moisture depth (inches) on northern desert shrub vegetation type for Carson City north of Reno (Site 03A-3) for 1977 and 1978.

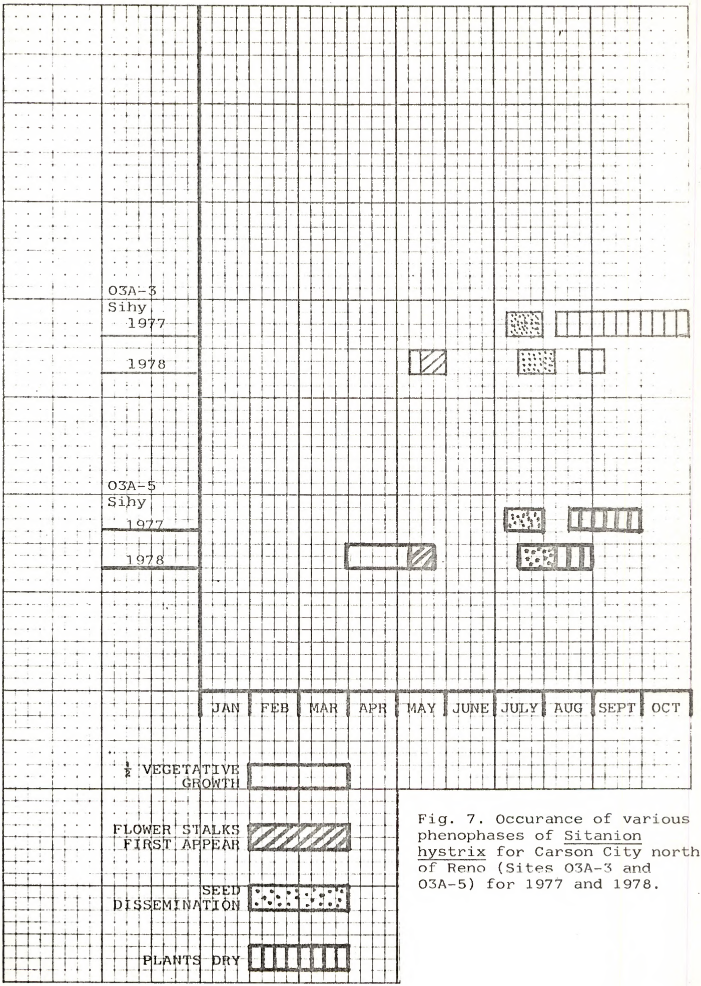

Fig. 7. Occurance of various phenophases of Sitanion hystrix for Carson City north of Reno (Sites 03A-3 and 03A-5) for 1977 and 1978.

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MADE IN U. S. A.

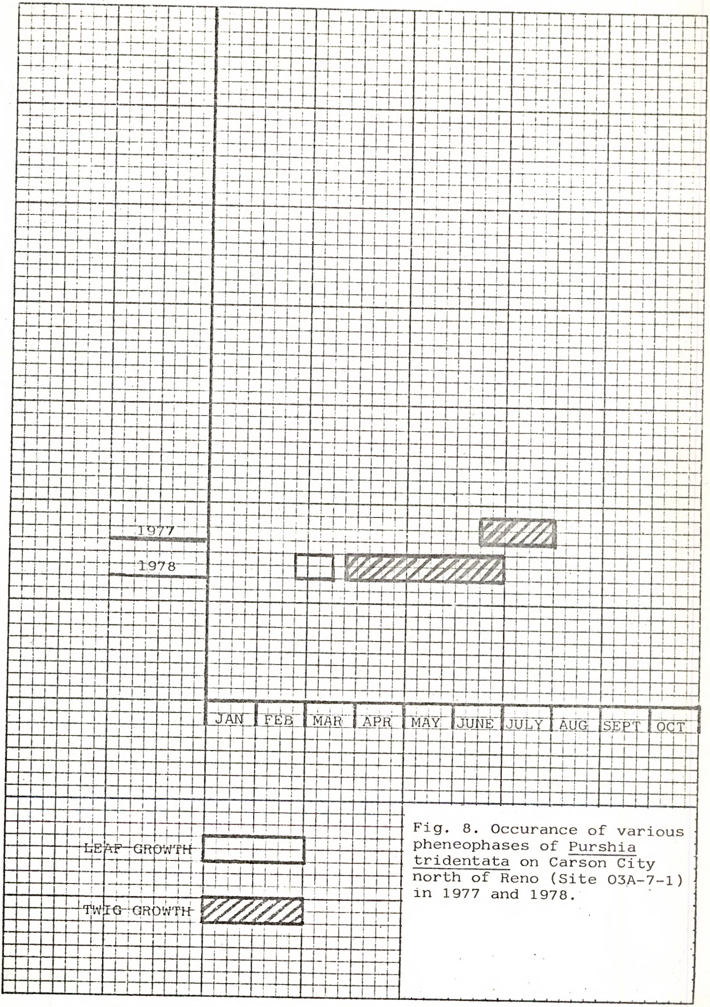


Fig. 8. Occurance of various pheneophases of Purshia tridentata on Carson City north of Reno (Site 03A-7-1) in 1977 and 1978.

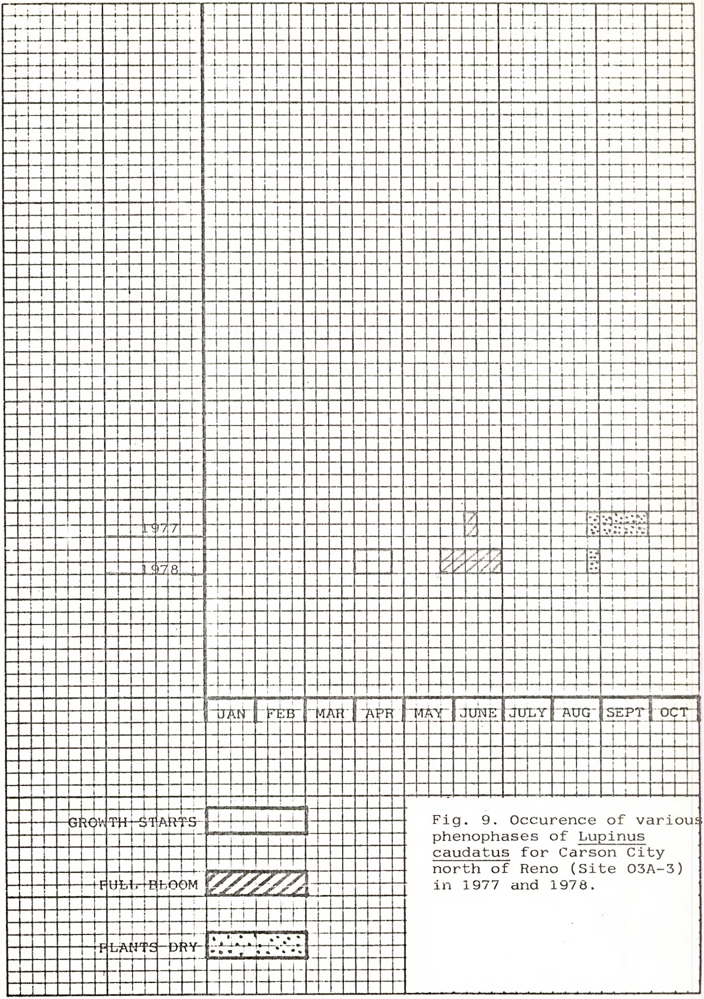


Fig. 9. Occurence of various phenophases of Lupinus caudatus for Carson City north of Reno (Site 03A-3) in 1977 and 1978.

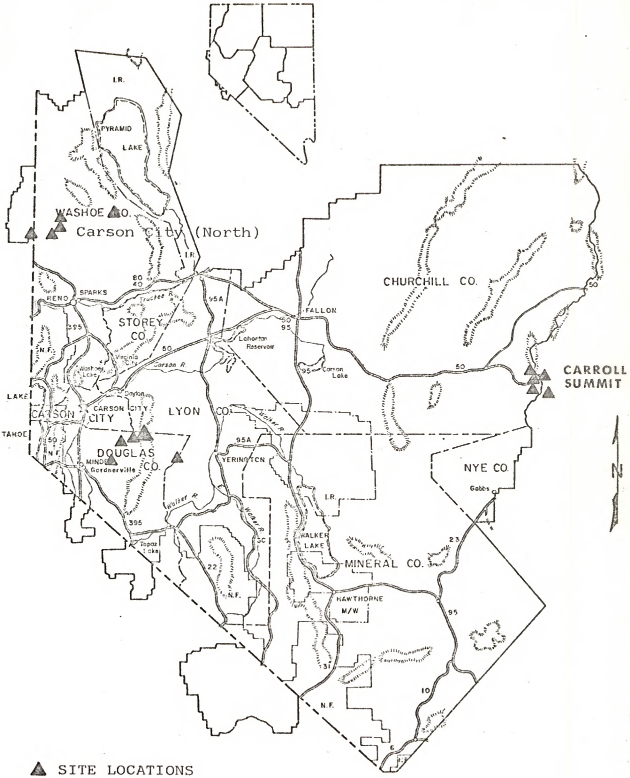
Table 1. Leader (Shrubs) and Height (Grasses) Growth in Carson City District (North of Reno) in 1977 and 1978.

	Millimeters			
	1977	Regrowth	1978	Regrowth
Site 03A-2 Estab. 1978				
SHRUBS				
1. Grsp			152	
2. Atco			175	
3. Artr			190	
4. Save			160	
5. Arsp			78	
6. Atca			120	
7. Cela			180	
GRASSES				
1. Orhy			490	
2. Sihy			340	
3. Stth			505	
4. Brte			315	
Site 03A-3				
SHRUBS				
1. Artr	170		175	
2. Chvi	150		180	
3. Pran	80		150	
4. Teca	160		160	
5. Ribes sp.			270	
6. Grsp	120		110	
GRASSES				
1. Stco	750		560	
2. Brte	250	220	225	
3. Orhy	310		260	

	Millimeters			
	1977	Regrowth	1978	Regrowth
Site 03A-3 con't				
GRASSES				
1.Sihy	230		320	
FORBS				
1.Luca	180		470	
Site 03A-4				
SHRUBS				
1.Teca			230	
2.Atca	135		130	
3.Chvi			110	
GRASSES				
1.Agcr	70		920	
2.Elci	875		1300	
3.Agin	500		890	
4.Sihy	280		500 (plowed up)	
5.Sece	900		1200	
6.Brte			280	
FORBS				
1.Basa	350		450	
Site 03A-7-1				
SHRUBS				
1.Artr	150		170	
2.Putr	35		100	
3.Chvi	180		160	
4.Ribes sp.	60		155	
5.Teca	175		245	

	Millimeters			
	1977	Regrowth	1978	Regrowth
Site 03A-7-1 con't				
GRASSES				
1.Orhy	480		380	
2.Stth	490		380	
3.Brte	280		130	
4.Sihy	400		390	
5.Feme	22		45	
6.Agcr	500		690	
FORBS				
1.Wyeth sp.	560		480	
2.Luca	220		340	
Site 03A-7-2				
SHRUBS				
1.Cele	125		40	
2.Artr	165		200	
3.Ceve	140		135	
4.Ribes sp.	105		180	
5.Chvi	130		120	
6.Putr	100		110	
7.Teca	190		180	
8.Chna			180	
GRASSES				
1.Mebu	300		315	
2.Posa	90		300	
3.Sihy	460		285	
4.Stth	470		340	
5.Brte			225	

Site 03A--7-2 con't	1977	Regrowth	1978	Regrowth
	Millimeters			
FORBS				
1.Luca	250		320	
2.Wyeth sp.	530		490	



▲ SITE LOCATIONS
(Not all sites shown due
to closeness)

CARSON CITY DISTRICT

SYMBOL 1978	–	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)		S 45	S 45	3 45	3 45	S 45	5 45	3 45	2 45	3 45	3 45	6 45	9 45	5 45	15 45	21 45	23 45	D	D	D	D		D		D										
Precip.(mm)									0	5	0	1	10	0	0	0	0	0	3	0	0		0		0										
S.T.-°C				13	13	9	14	11	14	17	16	18	15	19	21	21	20	25	26	25	29		29		26										
Carson City-N.)3A-2																																			
SHRUBS																																			
Grsp		LG		TG BV		FG			1B			FB				BO		SD	SD LY		LY														
Atco		LG				TG BV					FG		FB					BO	SR	SD LY					LY										
Artr		LG		TG												BV				FG															
Save		LG		TG			BV							FG	1B			FB	BO	SD	SD LY		LY												
Arsp		LG		TG	BV		FG	1B					FB	BO		SR LY	SD	LD																	
Atca ♀		LG						TG	BV				1B		FB			–		BO	SR LY														
♂		LG						TG	BV				1B		FB			BO		–	LY														
Cela		LG		TG					BV		1B			FB		BO		SR		SD	SD LY		LY												
Tegl		LG			TG BV		FG							1B	FB	FB LY			SR LY	SD LD	LD														
GRASSES																																			
Orhy		GS				$\frac{1}{2}$V		FS		HO				An		DS	HS	SD BD			BD		PD												

YMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
MD(From-To in cm)																																		
recip.(mm)																																		
.T.-°C																																		
Carson City-N. 03A-2 con't																																		
GRASSES																																		
Sihy		GS				½V		FS			HO			An	DS	HS		SD BD			PD													
Stth		GS				½V				FS		HO		An	DS		HS	SD BD			PD													
Brte				GS				HO							An	DS	HS BD	SD	SD BD	PD														
FORBS																																		

YMBOL 1978	FEB 24	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
MD(From-To in cm)	S 45	S 45	S 45	2 45	S 45	S 44	4 45	5 45	1 45	1 45	5 45	8 45	6 45	5 45	11 45	22 45	D	D	S 30	D	D		D		D										
recip.(mm)									1	10	0	3	12	0	0	0	0	0	11	0	0		3		0										
.T.-°C				12	6	6	11	10	9	13	14	14	16	15	20	22	21	21	20	28	25		25		24										
rson City-N. 3A-3																																			
HRUBS																																			
rtr		TG																BV		FG															
hvi	LG												TG					BV							BO										
ran	D			TG				BV	LG		1B	FB		BO					SR	SD					LY										
eca	D	LG		TG							BV								FG	1B	FB		BO		SD										
ibes sp.			TG			BV			1B			FB		BO			SR				SD LY		LD												
rsp ♀	LG					TG			BV				FG		1B	FB	BO	–	SR	SD			LY												
♂	LG					BV			–			FG			1B	FB	–	BD	SR	LY			–												
RASSES																																			
tco	D	GS									½V	FS	HO		An		DS	HS	HS BD	SD BD			BD		PD										
rte	GS										FS	HO				DS	HS	SD BD		PD					–										
rhy	D		GS								½V	FS	HO		An	DS		HS	SD	SD BD			BD		PD										
ihy	GS										½V	FS		HO	An			DS	HS	SD BD			BD		PD										

YMBOL 1978	FEB 24	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
MD(From-To in cm)																																			
recip.(mm)																																			
.T.-°C																																			
Carson City-N 03A-3 con't																																			
FORBS																																			
Luca	D					GS			FS			1B	FB					BO		SR	DS		BD		PD										

SYMBOL 1978	FEB 24	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)	S 45	S 45	S 45	1 45	S 45	S 45	2 45	2 45	4 45	4 45	8 45	4 45	9 45	7 45	14 45	25 45	19 45	18 45	20 70	15 70	D		D		D										
Precip.(mm)									0	8	0	6	13	0	0	0	0	1	11	0	1		7		0										
S.T.-°C				13	4	4	10	8	5	7	18	18	16	20	23	22	22	29	24	24	25		25		25										
Carson City-N. 03A-4																																			
SHRUBS																																			
Atca	D		LG	TG														FG		1B	BO				SR										
Chvi	LG												TG				BV	BV		FG					1B										
Teca		LG		TG							BV									FG	1B		BO		SR										
GRASSES																																			
Agcr	GS					$\frac{1}{2}$V						HO					An		DS				SD		SD BD										
Elci	GS					$\frac{1}{2}$V					FS			HO		An		DS		HS			SD		SD BD										
Agin	GS					$\frac{1}{2}$V						FS	HO							An	DS		SD												
Sece	D					GS					$\frac{1}{2}$V	FS	HO		An		DS		HS				SD		SD BD										
Brte	GS							$\frac{1}{2}$V			HO			An	DS	DS BD	HS	SD BD		PD															
FORBS																																			
Mesa	GS														FS	1B		FB	BO						SR										
Onobr sp.	GS											FS		1B			FB	BO	SR		DS														

YMBOL 1978	FEB 24	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
MD(From-To in cm)	S 60	S 45	S 50	1 45	S 45	S 45	S 45	S 45	1 45	1 45	3 45	4 45	S 45	4 45	9 45	21 45	22 45	23 45	S 90	7 90	D		D		D										
recip.(mm)									1	16	0	5	21	0	0	0	0	0	11	0	0		1		0										
.T.-°C				10	6	6	8	7	9	7	15	16	17	17	22	20	21	20	20	25	24		25		24										
arson City-N. 3A-5																																			
HRUBS																																			
rsp ♀	LG				-	TG			BV		FG		1B	FB			BO	SR	SD				LY		LD										
♂	LG				BV	TG		FG					1B	FB			BO	-	SR	SD	LY		-		LD										
rtr	D		TG															BV																	
hvi	LG					TG												BV							BO										
ibes sp.	LG			BV		1B				FB		BO		TG BO			SR		SR LY	SD LY			LD												
pvi	D							TG					BV				1B	FB	BO	SD			LY												
RASSES																																			
rte	GS										FS	HO			An	DS	HS	BD	SD BD	PD															
tco	D	GS				½V					FS		HO		An		DS	HS	SD	SD BD			BD		PD										
rhy	D	GS				½V					FS		HO		An	DS		HS	SD BD				BD		PD										
ihy	GS					½V					FS		HO		An			DS BD	HS	SD BD			PD												
ORBS																																			
Basa	D					GS			FS	1B		FB			BO		SR	SR BD		DS BD			BD		PD										

YMBOL 1978	FEB 24	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
MD(From-To in cm)	7 60	S 45	S 45	S 45	S 45	S 45	2 45	S 45	1 45	1 45	4 45	3 45	5 45	3 45	5 45	5 45	30 45	22 45	S 20	5 20	D		D		D										
recip.(mm)									0	11	0	5	14	0	0	0	0	1	20	0	0		5		0										
.T.-°C				9	4	4	10	8	9	9	13	15	17	14	20	19	23	19	20	21	25		24		22										
arson City-N. 3A-7-1																																			
HRUBS																																			
rtr	D		TG															BV	FG																
utr	LG			TG					BV			FG	1B	FB		BO					SR				SD LY										
hvi	D	LG											TG					BV		FG					FB										
ibes sp.	D	LG	TG			BV	1B					FB		BO									SR LY		SD LY										
eca	D	LG		TG							BV								FG		1B		FB		BO										
RASSES																																			
rhy	D		GS			½V							FS		An		DS		HS	SD	SD BD		BD												
tth	D				GS						½V			FS	HO	An		DS	HS		SD		BD												
rte	D	GS									½V	FS	HO		An	DS	HS BD		SD BD	PD															
ihy	GS					½V						FS			HO	An	DS			HS	SD BD		BD												
eme	D					GS						FS		HO			An	HS BD	SD BD	PD															
gcr	D	GS				½V						FS			HO				An		DS				SD										

YMBOL 1978	FEB 24	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
MD(From-To in cm)																																			
recip.(mm)																																			
.T.-°C																																			
arson City-N. 3A-7-1 con't																																			
ORBS																																			
yeth sp.	D					GS						FS	1B		FB	BO				DS	BD														
uca	D					GS					FS			1B	FB		BO			SR	DS		DS BD		BD										

SYMBOL 1978	FEB 24	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD (From-To in cm)					S 45	S 45	2 45	2 45	2 45	45	2 45	3 45	45	3 45	7 45	19 45	20 45	25 45	70	11 70	D				D										
Precip. (mm)									0	11	0	12	14	0	0	0	0	1	9	0	0		6		0										
S.T.-°C					2	2	5	3	5	7	9	16	14	13	18	17	17	16	20	20	21		20		20										
Carson City-N. 03A-7-2	S	N	O	W																															
SHRUBS																																			
Cele					LG			BV			FG	FB		BO					SR	TG SR			SD												
Artr					TG													BV	FG																
Ceve					TG						BV			FG	1B	FB		BO			SR		SD												
Ribes sp.					TG				BV	1B				FB	BO								SR		SD										
Chvi					D		LG						TG						BV						1B										
Putr					LG	TG							BV	FG	FB			BD					SR		SD										
Teca					D				TG									BV	FG				FB		BO										
Chna																	TG			BV															
GRASSES																																			
Mebu					GS							HO		An			HS	SD	SD BD		BD														
Posa					GS				½V		HO			An			DS	HS	SD BD	BD	PD														
Sihy					GS							FS		HO			An		DS		SD		SD BD		BD										
Stth					GS							½V		FS	HO		An		DS		SD				BD										

YMBOL 1978	FEB 24	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
MD(From-To in cm)										
recip.(mm)										
.T.-°C										
arson City-N. 3A-7-2 con't										
RASSES										
rte			GS	FS HO	An	HS BD SD BD PD				
ORBS										
uca		D	GS	FS	1B FB	BO	SR DS DS			
yeth sp.		D	GS		FS 1B	FB BO	DS BD			

ELY

Ely field personnel observed that several species on their study sites did not produce any seeds this year. Included in those species are bluestem wheatgrass (*Agropyron smithii*; sites 04-3 and 04-8), and hook violet (*Viola adunca*; site 04-6). Bluestem wheatgrass growing on the mountain brush site (04-7) had only a few seeds. They noted that only one creeping barberry (*Berberis repens*) plant bloomed on site 04-8.

Field personnel also felt that their valley sites were generally ahead this year, but that the higher elevation sites appeared to be somewhat behind in phenological development when compared to the other years (1976 and 1977).

Twig growth for most shrubs was associated with warming soil temperatures. Grasses on these and other sites around the state begin their green growth early, usually in March. However, ½ of the culm growth, or the growth of reproductive culms, does not occur until warming in late May and early June. This seems to hold true over a range of elevations. Twig growth of winterfat (*Ceratoides lanata*) starts approximately three weeks prior to most other woody species on site 04-2 (annual phenodynamic tables).

The data for leader and height growth (Table 1) suggests that 1978 was not as good a growth year as 1977. This trend generally holds true for all Ely sites.

The phenology of bluestem wheatgrass and fairway wheatgrass (Agropyron cristatum) in the northern desert shrub type are very similar in their development (Figures 1 and 2). Seed development occurred over an eight week period for fairway wheatgrass, while seed development of bluestem wheatgrass took only six weeks. This constitutes a good example of the kind of data required for grazing management.

Height growth of bluestem wheatgrass varied considerably from year to year on a coniferous forest site (Figure 3). Height growth in 1978 was relatively late and short at this site (04-8). Leader growth of rabbitbrush (Chrysothamnus viscidiflorus) on a northern desert shrub site showed much less variability.

Figure 5 compares three grasses. The point of ½ vegetative growth varies more from year to year than from species to species. The onset of reproductive culms shows even less variability among years and species. Most reproductive culms appear during the first two weeks in June.

The phenological development of antelope bitterbrush (Purshia tridentata) in pinyon/juniper is relatively uniform from year to year (Figure 6). Some interesting departures are evident. In 1978, leaf and twig growth took place over a ten week period; in 1976, only two weeks; and in 1977, only three weeks. Such variations may have an important relationship to range readiness and productivity.

The onset of leaf and twig growth in selected shrubs (Figure 7) exhibits considerable variation among species and years. Figure 8 relates the annual phenodynamic of Indian ricegrass (*Oryzopsis hymenoides*) to soil moisture depth (Sites 04-3). No clear cut relationship is evident.

EUGENE DIETZGEN CO.
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NO. 340-3 DIETZGEN GRAPH PAPER
8 X 8 PER INCH

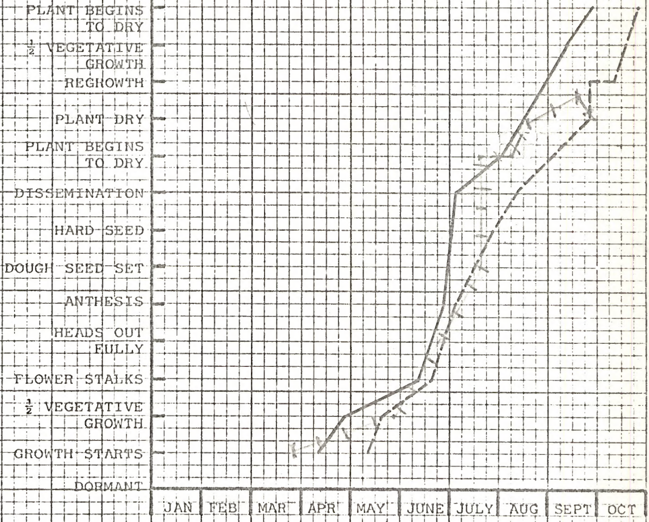

Fig. 1 . Phenology of *Agropyron smithii* in the northern desert shrub type (site 04-3), Ely District.

NO. 341 DIETZGEN GRAPH PAPER
8 X 8 PER INCH
MADE IN U.S.

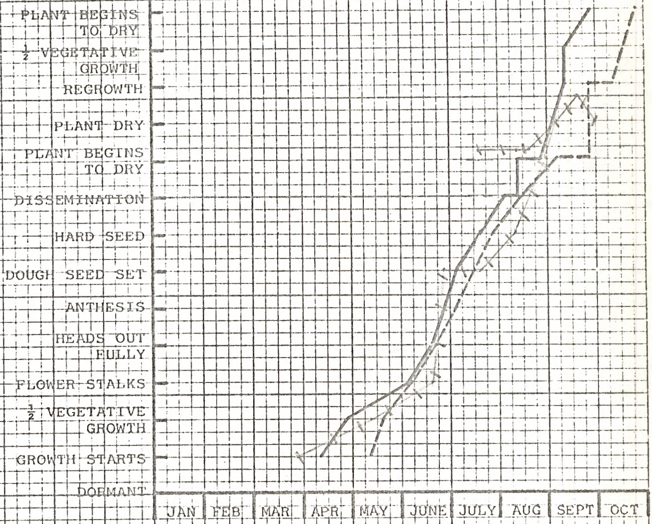

Fig. 2 . Phenology of Agropyron cristatum in the northern desert shrub vegetation type (site 04-3), Ely District.

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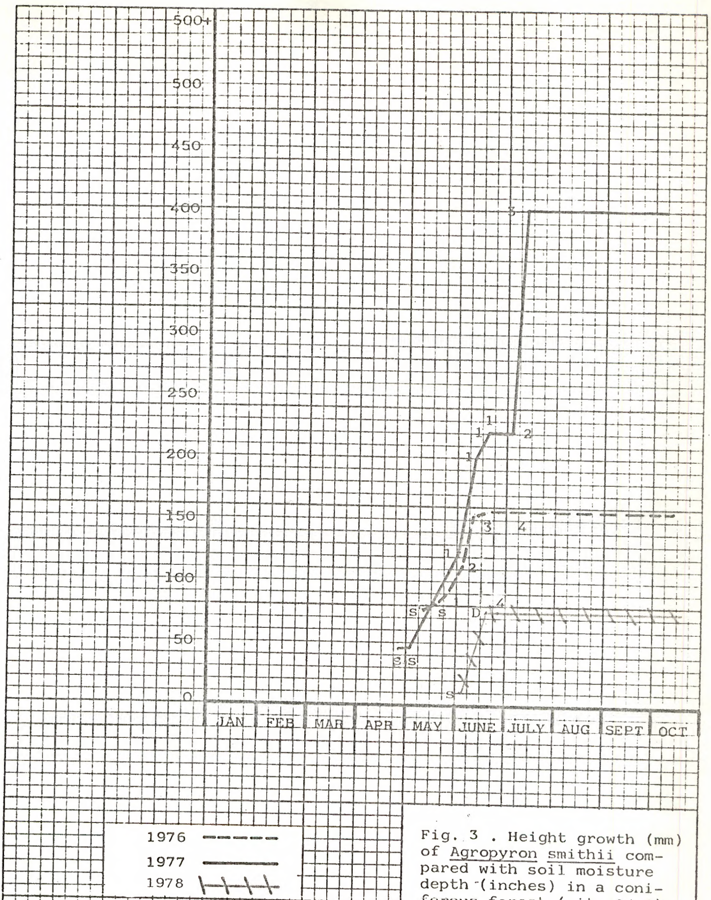

Fig. 3 . Height growth (mm) of Agropyron smithii compared with soil moisture depth (inches) in a coniferous forest (site 04-8), Ely District.

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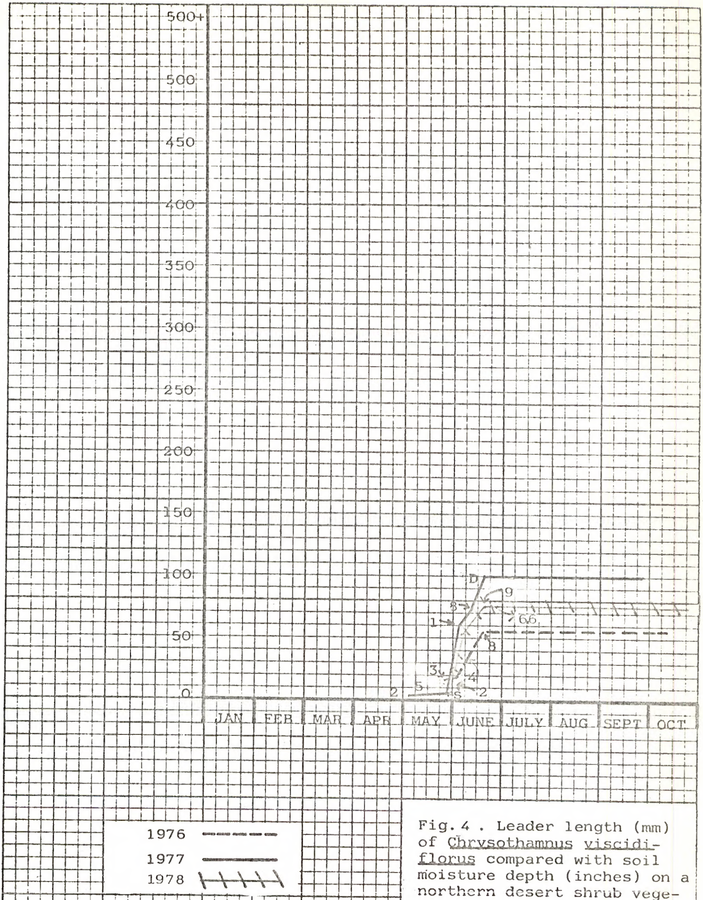

Fig. 4 . Leader length (mm) of Chrysothamnus viscidiflorus compared with soil moisture depth (inches) on a northern desert shrub vegetation type (site 04-3), Ely District.

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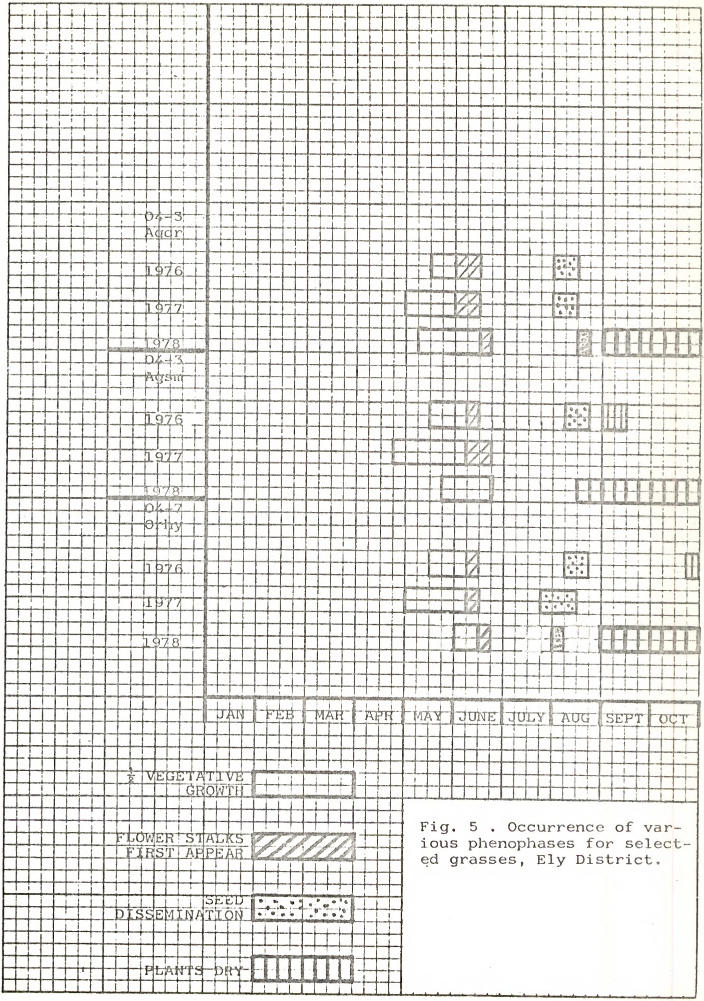

Fig. 5 . Occurrence of various phenophases for selected grasses, Ely District.

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NO. 340-B DIETZGEN GRAPH PAPER
8 X 8 PER INCH

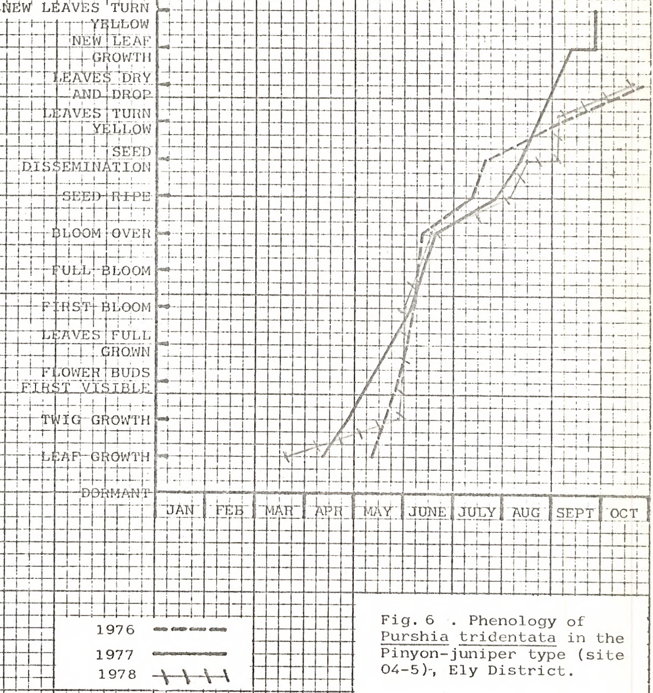

Fig. 6 . Phenology of *Purshia tridentata* in the Pinyon-juniper type (site 04-5), Ely District.

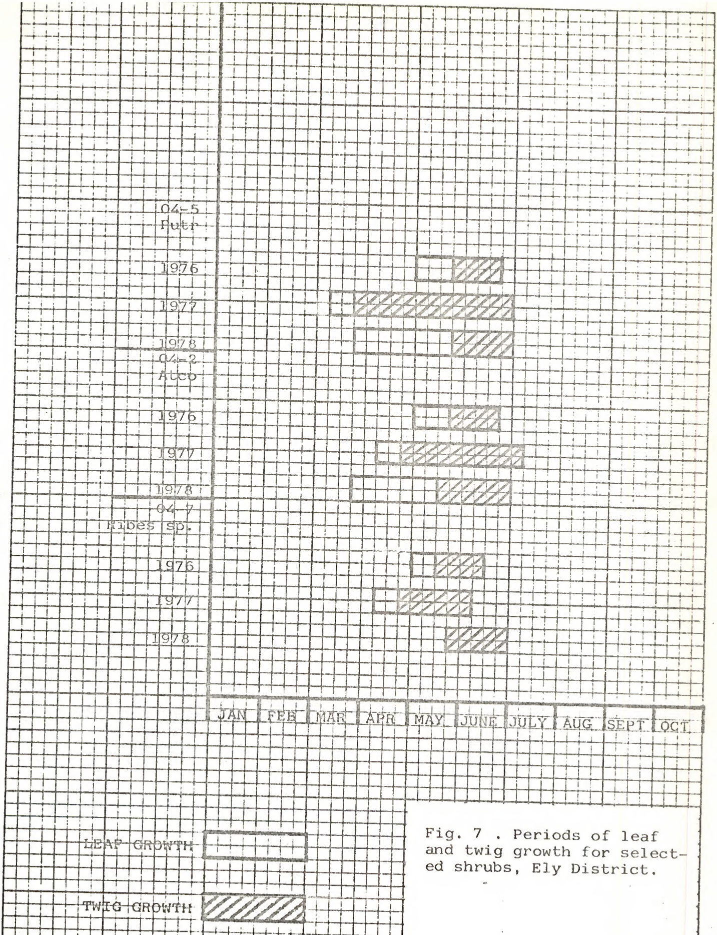

Fig. 7 . Periods of leaf and twig growth for selected shrubs, Ely District.

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EUGENE DIETZGEN CO.
MADE IN U. S. A.

NO. 341-8 DIETZGEN GRAPH PAPER
8 X 8 PER INCH

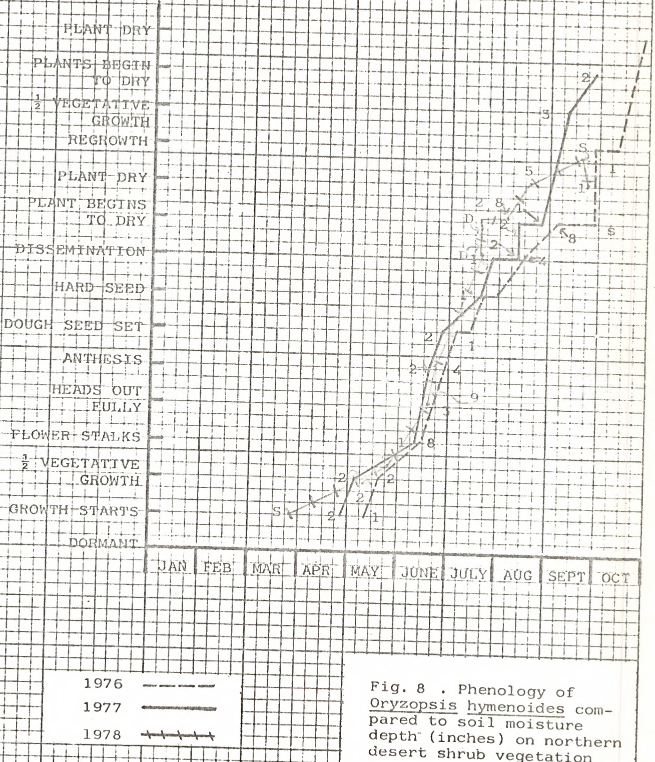


Fig. 8 . Phenology of Oryzopsis hymenoides compared to soil moisture depth (inches) on northern desert shrub vegetation type (site 04-3), Ely District.

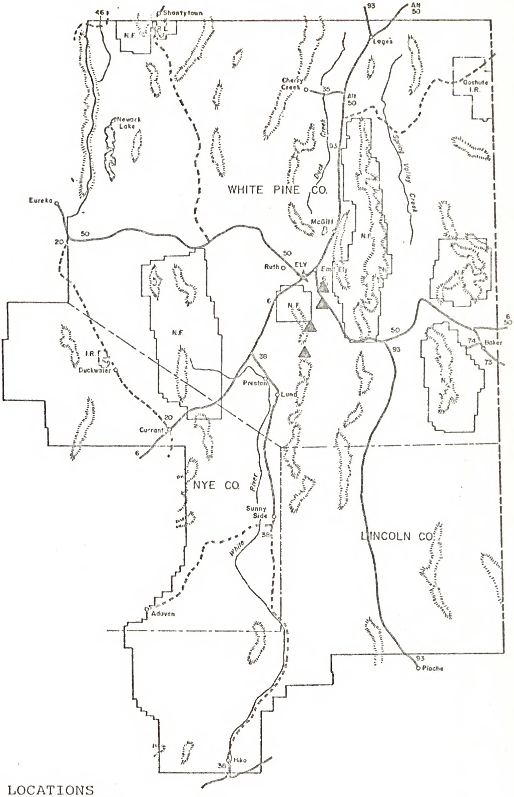
Table 1. Table of Leader(Shrubs) and Height (Grasses and Forbs) Growth in Ely District for 1976, 1977, and 1978.

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 04-2						
SHRUBS						
1.Artr	60		100		90	
2.Arsp	26		20		50	
3.Atco	50		105		90	
4.Cela	50		160		150	
5.Save	58		63		60	
GRASSES						
1.Orhy	240		190	165	200	
2.Sihy	255		210	100	280	
Site 04-3						
SHRUBS						
1.Artr	52		98		100	
2.Chvi	55		100		70	
GRASSES						
1.Agcr	310		455	150	330	
2.Orhy	300	75	375	160	400	
3.Agsm	270		450	75	170	
FORBS						
1.Astra sp.	55		75		75	
2.Phho	51		25		70	
Site 04-5						
SHRUBS						
1.Arno	25		125		35	
2.Putr	105		60		75	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site04-5 con't						
GRASSES						
1.Posa	210	25	150	50	310	
Forbs						
1.Pepa	250		340		530	
Site 04-6						
SHRUBS						
1.Salix sp.			70		4	
GRASSES						
1.Popr	300		500		260	
2.Carex sp.	170		320		210	
3.Juba	270		380		400	
4.Agal			800		450	
FORBS						
1.Popa	95		200		90	
2.Acla	300		550		90	
3.Taof	150		150		75	
4.Viad	75		90		70	
5.Thmo			450		310	
Site 04-7						
SHRUBS						
1.Cela	20		10		10	
2.Ribes sp.	52		20		7	
3.Amal	155		30		20	
4.Sylo	150		185		80	
5.Bere	20		75		100	
6.Artr	50		150		100	

			Millimeters			
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 04-7 con't						
GRASSES						
1.Agsm	210		425	75	140	
2.Pone	360		310		300	
3.Orhy	305		380	150	300	
4.Stco			600	75	170	
5.Agsp			500	75	200	
FORBS						
1.Meob	178		150		150	
2.Delph sp.	210		355		125	
3.Lupin sp.			255		150	
4.Casti sp.			355		150	
5.Lomat sp.	76		60		30	
Site 04-8						
SHRUBS						
1.Sylo	105		110		30	
2.Artr	50		80		50	
3.Amal	15		28		30	
4.Bere	30		77		30	
GRASSES						
1.Agsm	155		400		150	75
2.Pone	305		300		75	150
FORBS						
1.Meob	180		110		90	
2.Penst sp.	250		400		100	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 04-9 con't						
GRASSES						
1.Carex sp.	230		250		240	
2.Juba	330		350		400	
3.Dist	70		140		150	
FORBS						
1.Plma	210		170		220	



▲ SITE LOCATIONS
(Not all shown due
to closeness)

ELY DISTRICT

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT 19				NOV	
SMD(From-To in cm)					S 20			S 30				21 30	5 30	D		25 30	25 30			D		D	D	D	D	D	8 30	S 30	5 30			S			
Precip.(mm)								75				34	0	6		0	0					13	0	6	0	0	6	15	9						
S.T.-°C					8			4				14	13	20		16	20			24		22	30	18	23	20	16	13	10			8			
Ely 04-2																																			
SHRUBS																																			
Artr					LG							TG					FG												1B			BO			
Arsp					TG BV							1B	FB			BO	LY			LD															
Cela					LG			TG				BV		1B		FB				FB LY		LY						SR LY							
Atco					LG							TG BV				FB						FB LY	BO LY	LY				SR LY	SD						
Save ♀					LG							TG		-		-	1B			FB LY		SD			SD LY							LD			
♂					LG							TG		FG		BV	-			FB LY		SD			SD LY							LD			
GRASSES																																			
Orhy					GS							½V		FS		An DS	DS BD			SD BD		PD													
Sihy					GS			½V						HO		An	BD			PD															
FORBS																																			

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT 19				NOV	
SMD(From-To in cm)					S 30			S 30			S 30		5 30	5 30		23 30	16 30			D		7 30	26 30	13 30	10 30	13 30	5 30	S 30	3 30			3 30			
Precip.(mm)								84			71		0	5			0			0		11	0	6	0	0	6	21	10			10			
S.T.-°C					5			1			4		12	12		13	15			20		20	23	14	17	18	11	8	6			9			
Ely 04-3					-																														
SHRUBS																																			
Artr					LG								TG				BV			FG								1B				FB			
Chvi					LG								TG				FG						FB						BO						
GRASSES																																			
Agsm					GS								$\frac{1}{2}$V				HC			DS BD		BD		PD				gu	PD						
Orhy					GS								$\frac{1}{2}$V			HO An				SD BD		BD		PD				gu	PD						
Agcr					GS						$\frac{1}{2}$V					FS	DS			DS BD			HS	SD	BD	PD		gu	PD						
FORBS																																			
Phho					GS								1B	FB		BO	DS			BD				PD											
Astra sp.					GS						FS		FB							PD															

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)					S 30			S 30		S 30			3 30	15 30		18 30	15			D			15 30	5 30		18 30	3 30	5 30	1 30			S			
Precip.(mm)								76		59			0	5		0	0			0		25	0	-	0	0	1	21	10						
S.T.-°C					5			4		5			14	13		15	15			24		22	21	12	17	16	10	8	7			10			
Ely 04-5					-																														
SHRUBS																																			
Arno					LG								TG			BV	FG												1B			BO			
Putr					LG								TG BV	1B		BO						SR	SD			SD LY						LD			
GRASSES																																			
Posa					GS								½V	HO		An	BD			PD															
FORBS																																			
Pepa					GS								FS			FB	BD					SR	DS	BD		PD									

MBOL 1978	FEB	MARCH				APRIL				MAY				JUNE			
ID(From-To in cm)					S 30			S 30		S 30			S 30	S 30		S 30	S 30
ecip.(mm)								82		(CAN STOLEN)							
.T.-°C					7			4		7			13			14	15
Ely 04-6					-												
SHRUBS																	
Salix sp.								LG					TG	FG		BO	SR SD
GRASSES																	
Carex sp.					GS					$\frac{1}{2}$V			An				HS
Juba					GS					$\frac{1}{2}$V						FS	An
Agal					GS									$\frac{1}{2}$V			HO
Popr					GS								FS	HO		An	
FORBS																	
Popa					GS					FS				FB		BO	
Viad					GS					1B			FB	BO			
Thmo					D			FS					FB	BO			
Acla					GS												FS
Taof					GS					1B			FB BD			DS	BD

MBOL 1978	JULY				AUG				SEPT				OCT				NOV	
ID(From-To in cm)			S 30												S 30			
ecip.(mm)																		
.T.-°C			16		18	16	12	13	13	11	10	8			8			
Ely 04-6																		
SHRUBS																		
Salix sp.			SD				LY								LD			
GRASSES																		
Carex sp.			HS SD		SD			BD							PD			
Juba			DS		HS	SD			BD						PD			
Agal			An			HS		BD	PD									
Popr			SD BD		PD													
FORBS																		
Popa											PD							
Viad			BD		BD						PD							
Thmo			BO BD		DS		BD				PD							
Acla			1B		FB			BO	BO BD			SR				PD		
Taof											PD							

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)													2 30	10 30		10 30	20 30			D		1 15	13 +	5 30	10 30	12 30	2 30	S 30	1 30			S			
Precip.(mm)														4		-	0			3		41	1	-	-	0	16	-	12						
S.T.-°C													10	10		12	13			20		18	16	10	14	12	10	8	7						
Ely 04-7	--	--	--	--	--S	N	OW	--	--	--	--	--																							
SHRUBS																																			
Cele													TG BV	FB		BO				SR		SD				LY	FG LY		gu						
Ribes sp.													TG FG	FB		BO				LY				SR		SD		SD LY	LY			LD			
Amal													TG	1B		BO				BO LY			SR	LY								LD			
Sylo													TG			BV	1B			BO LY			SR	SD	LY							LD			
Bere													LG	FG						BO			LY									gu fr			
Artr													TG				FG										LY	1 B				FE			
GRASSES																																			
Agsm													½V				HO			DS		BD		PD											
Pone													FS	HO		An	SD BD			BD						PD									
Orhy													GS	½V		FS	An			DS		SD	BD			PD									
Stco													½V			FS	DS			HS		BD				PD									
Agsp													GS	½V			HO			DS		BD				PD									

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
SMD(From-To in cm)																																		
Precip.(mm)																																		
S.T.-°C																																		
Ely 04-7 con't																																		
FORBS																																		
Meob													1B	FB			PD																	
Delph sp.													GS	1B BD		FB	BD			PD														
Lupin sp.	SNOW		SNOW				SNOW				SNOW		GS	FS		1B	BO					BD		PD										
Casti sp.													D			FB						BO							DS			PD		
Lomat sp.													1B	FB		BO	PD																	

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)														S 30		D	10 30			D		-	12 30	7 30	5 30	12 30	1 30	-	S 30			S			
Precip.(mm)														–			0			–		31	5	24	0	-	16	-	40						
S.T.-°C														7		10	15			20		17	14	8	10	11	8	7	4			5			
Ely 04-8	---	---	---	---	--S		N	O		W--	---	---	--																						
SHRUBS																																			
Sylo														LG		TG	FG			BO			SR	SD	LY							LD			
Artr														D		TG				FG									1B			FB			
Amal														LG		BV	BO fr			SD			SF	LY								LD			
Bere														LG		BV	BO fr			SD		LY										gu			
GRASSES			SNOW				SNOW				SNOW																								
Agsm														GS			$\frac{1}{2}$V			HO		DS		BD		PD									
Pone														GS		$\frac{1}{2}$V	An			SD BD		PD													
FORBS																																			
Meob														1B		FB	BD			PD															
Penst sp.														GS			FS			BO			SR	BD	PD										

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
SMD(From-To in cm)					S			S				S 30	D	8 30		S 30	S 30			S 30		–	–	–	–	–	–	–	S 30			–		
Precip.(mm)								58				39	0	0		0	0			–		6	0	10	0	0	13	14	10					
S.T.-°C					7			10				12	16	18		15	-			20		20	18	18	18	14	12	10	8			8		
Ely 04-9																																		
GRASSES																																		
Carey sp.					GS			FS				An					As			SD			BD	PD										
Juba					GS							½V					An			DS		HS	SD	SD BD		BD						PD		
Dist					GS			½V						FS		An	DS			DS BD		HS		SD	PD									
FORBS																																		
Plma					D			GS				FS		1B			FB			BO				BO			DS	BD				PD		

LAS VEGAS

LAS VEGAS

Las Vegas field personnel noted that spreading creosote bush (Larrea divaricata) on one of their southern desert shrub sites (05-1-1) never lost its leaves during the winter. A similar situation occurred for blackbrush (Coleogyne ramosissima; site 05-1-2); sagebrush (Artemisia tridentata; site 05-3); and cliffrose (Cowania stansburiana, site 05-7). Winterfat (Ceratoides lanata; site 05-2) still had some seeds left on the plants from last year.

Many species react in a very positive way to a spring storm. For example, Stansbury cliffrose started its bloom cycle to coincide with a relatively heavy storm during the first week of May in 1978. Winterfat, blackbrush, littleleaf krameria (Krameria parvifolia) and desert globemallow (Sphaeralcea ambigua) all show a similar relationship (annual phenodynamic tables). This also seems to be related to warm soil temperatures occurring at the same time.

Spiny hopsage (Grayia spinosa) is another salt desert shrub species that shows a rather remarkable similarity in its phenodynamic when the three years are compared (Figure 1). Growth started in February and most activity ended by late June. This seems to be a rather long growth period, which is probably related to the more southerly location.

The phenology of big galleta grass (Hilaria rigida) showed considerably greater variability (Figure 2) over a long growing period. Reproductive activities for this species occurred much later in 1977 than in either 1976 or 1978. The reasons are not clear, but are probably related to soil moisture. The prediction of such anomalies would be useful in a grazing management system.

Galleta grass (Hilaria jamesii; Figure 3) shows a similar long growth period as big galleta grass, but less variability. This is also evident as the two species are compared on Figure 4. Seed dissemination periods are all relatively short - one to two weeks - occurring mostly in late June or early July.

The three year record of phenology for Indian ricegrass (Oryzopsis hymenoides; Figure 5) shows a close annual correspondence in development, with the greatest variation occurring during the last phenophases and regrowth phenophases. Height growth in this same species (Figure 6) was greatest for 1978, but does not appear to be strongly related to soil moisture. These data show that growth and development take place over an approximate 12 to 14 week period, irrespective of the year, but that the beginning and end of development may differ by four to five weeks from year to year.

Leader growth of white bur-sage (Ambrosia dumosa) varies by year (Figure 7) and may take place rather rapidly when there is good soil moisture (1976 and 1978), and slowly when soil moisture is less adequate (1977).

The onset of various phenophases for desert globemallow (Figure 8) appears to be regulated by site more than year.

However, there is a several week variation in the initiation of growth at site 05-7. The onset of bloom and bloom period is rather uniform within each site, but took place several weeks sooner at site 05-1-1. This site is nearly 2,000 feet lower in elevation than the other sites, thus offering a reasonable explanation.

Leaf and twig growth in shrubs varies from species to species (Figure 9). The ratio of leaf to twig growth seems to be fairly constant for big sagebrush and littleleaf krameria (late start for study in 1976). Stansbury cliffrose shows six weeks of leaf growth prior to twig growth in 1977, but only one week of leaf growth prior to twig growth in 1978.

Leader and height growth data for these sites shows considerable variability with few clear-cut trends (Table 1). For some species, 1978 was a good growth year, while for others, 1977 seems to be the best year.

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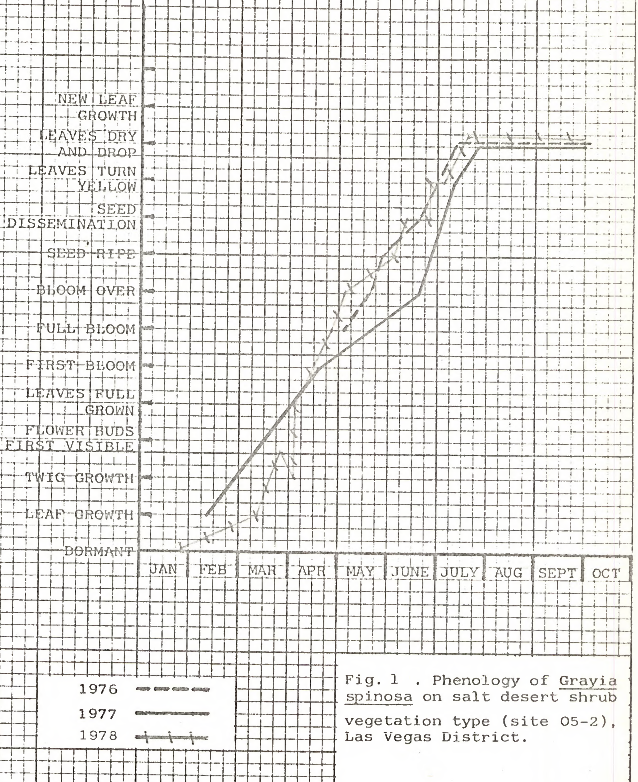

Fig. 1 . Phenology of Grayia spinosa on salt desert shrub vegetation type (site 05-2), Las Vegas District.

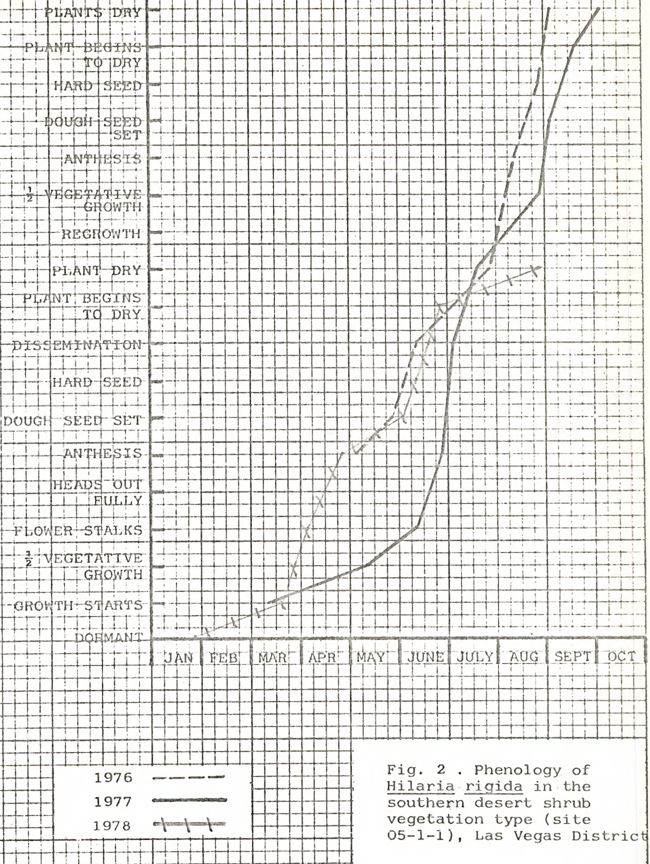

Fig. 2 . Phenology of *Hilaria rigida* in the southern desert shrub vegetation type (site 05-1-1), Las Vegas District.

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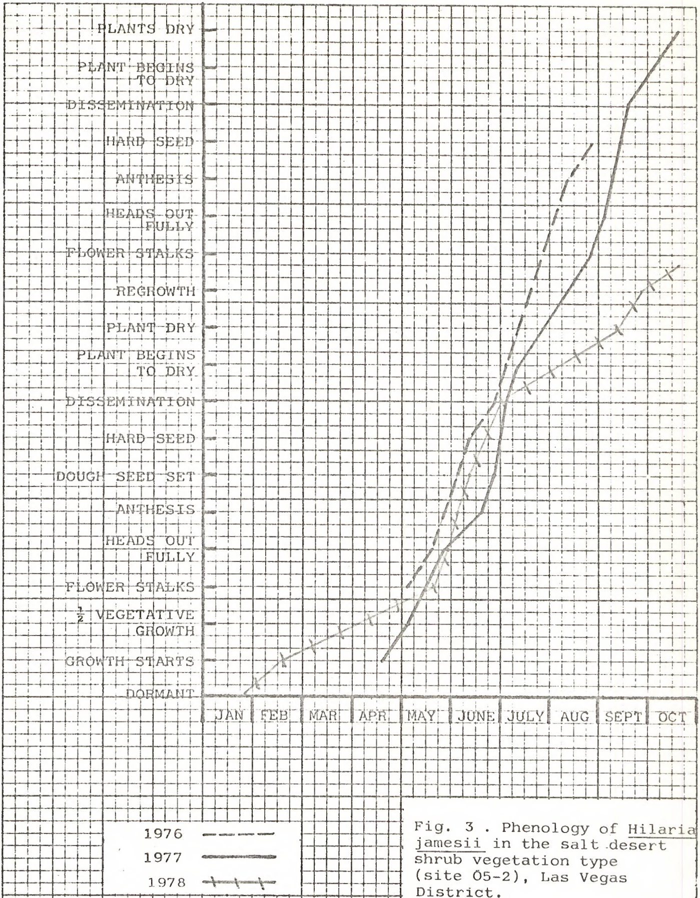

Fig. 3 . Phenology of Hilaria jamesii in the salt desert shrub vegetation type (site 05-2), Las Vegas District.

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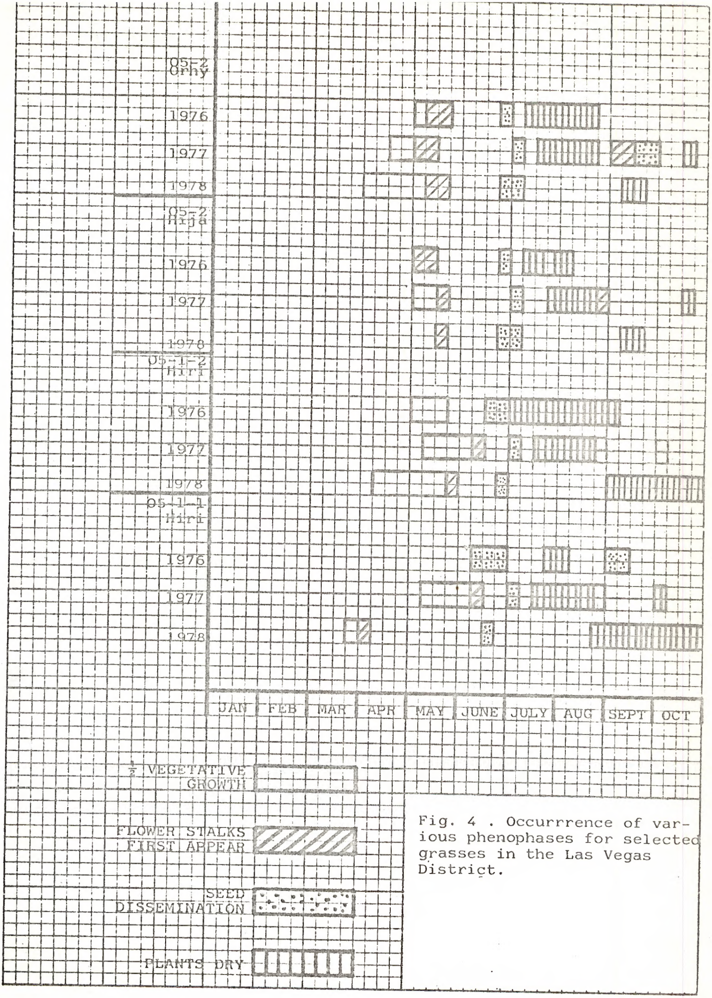

Fig. 4 . Occurrrence of various phenophases for selected grasses in the Las Vegas District.

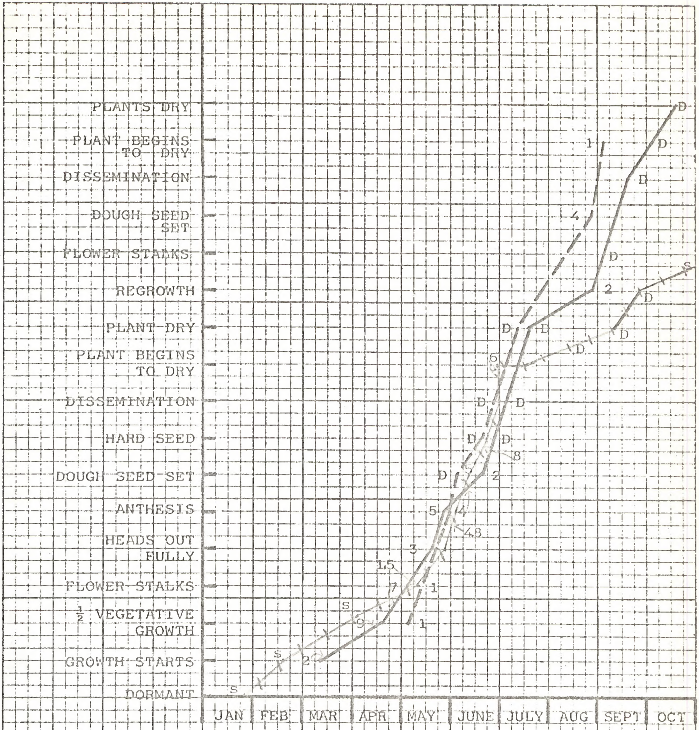

Fig. 5 . Phenology of Oryzopsis hymenoides compared with soil moisture depth (inches) on salt desert shrub vegetation type (site 05-2), Las Vegas District.

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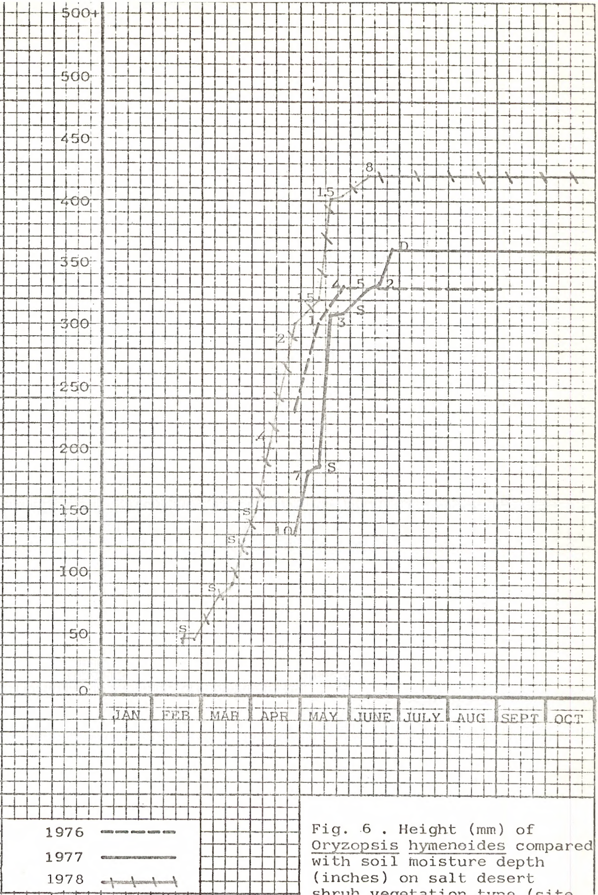

Fig. 6 . Height (mm) of Oryzopsis hymenoides compared with soil moisture depth (inches) on salt desert shrub vegetation type (site 05-2), Las Vegas District.

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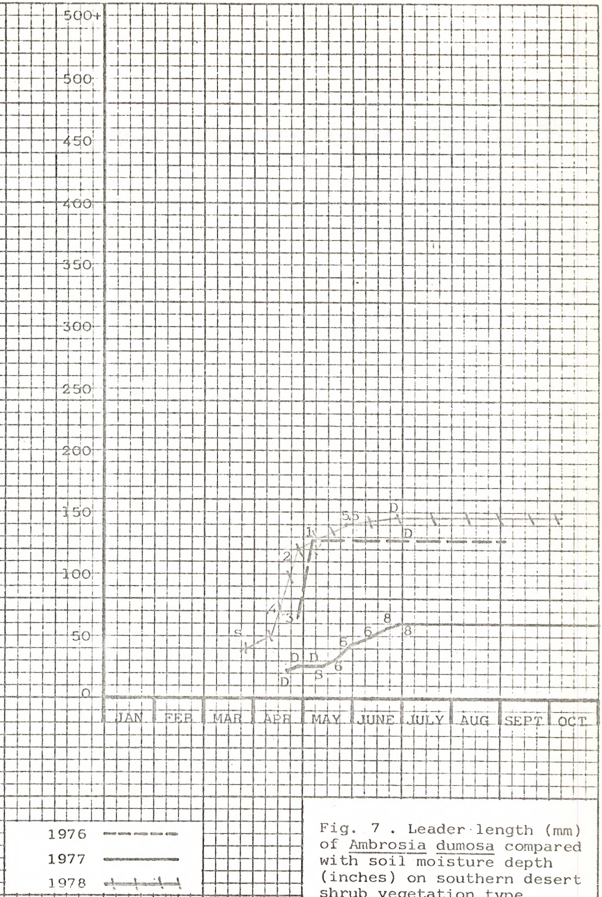

Fig. 7 . Leader length (mm) of Ambrosia dumosa compared with soil moisture depth (inches) on southern desert shrub vegetation type (site 05-1-1), Las Vegas District.

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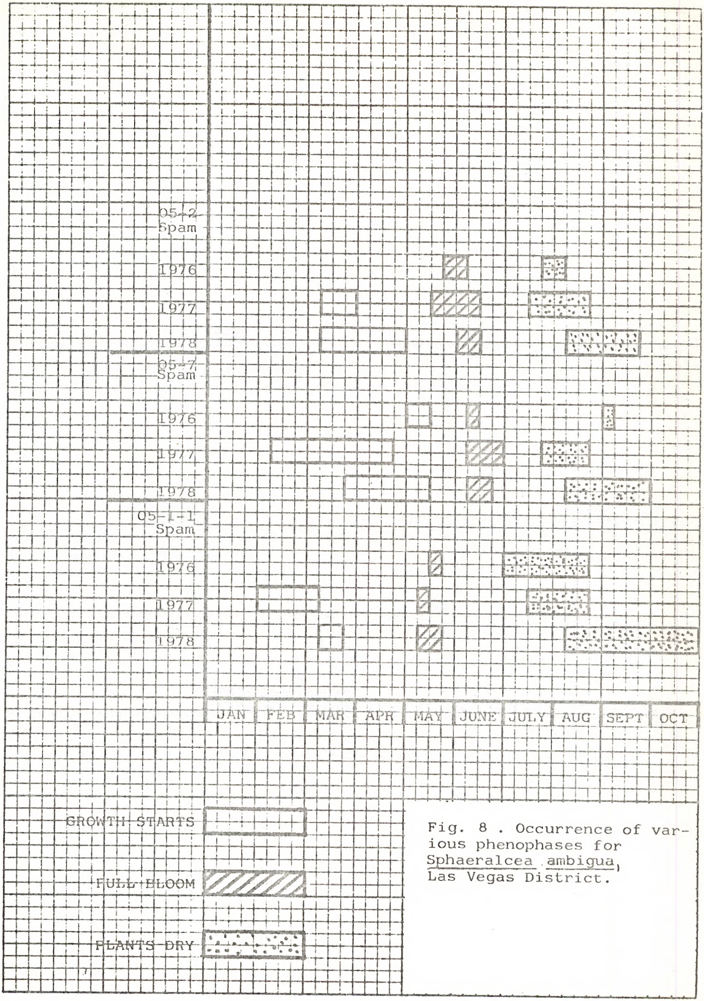

Fig. 8 . Occurrence of various phenophases for Sphaeralcea ambigua, Las Vegas District.

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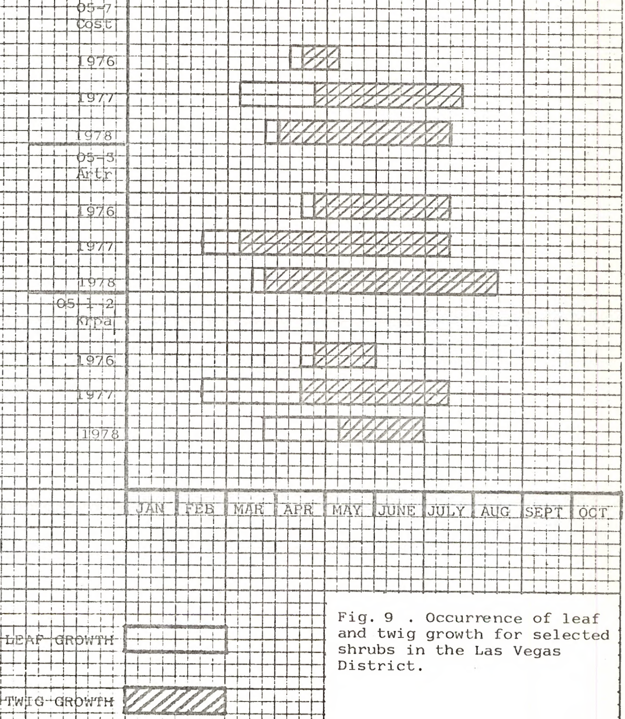


Fig. 9 . Occurrence of leaf and twig growth for selected shrubs in the Las Vegas District.

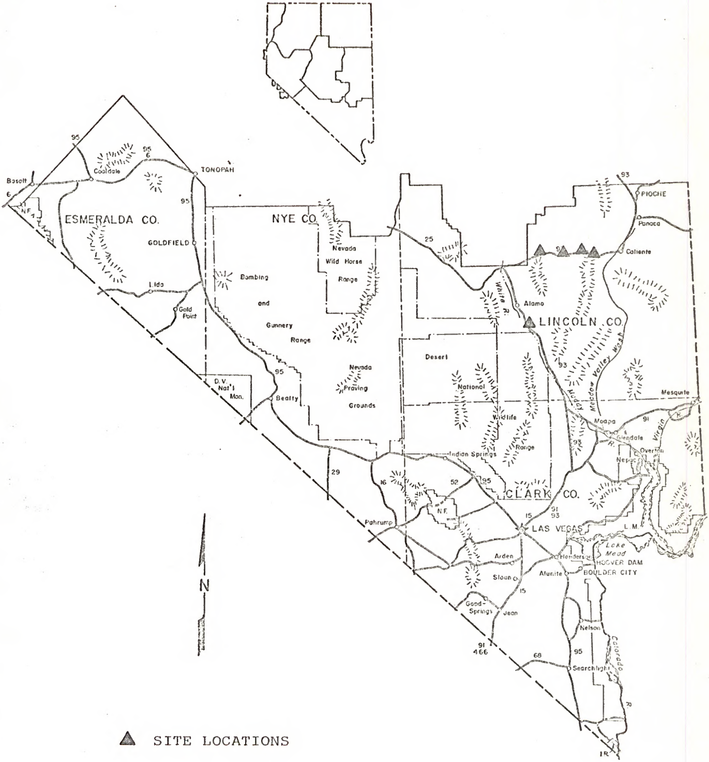
Table 1. Table of Leader (Shrubs) and Height (Grasses and Forbs) Growth in the Las Vegas District for 1976, 1977, and 1978.

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 05-1-1						
SHRUBS						
1.Amdu	101		60		143	
2.Ladi	50		101		44	
3.Dafr	101		140		205	
4.Grsp	152		32		140	
GRASSES						
1.Hiri	355	304	461	350	409	
FORBS						
1.Spam	508		182	85	485	
Site 5-1-2						
SHRUBS						
1.Cora	50		59		64	LG*
2.Krpa	25		193		105	60
3.Epne ♀	76		63		190	
♂			140		205	
GRASSES						
1.Hiri	304		420		120	75
Site 05-2						
SHRUBS						
1.Arsp	76		35		75	
2.Grsp	76		91		70	
			141		80	
3.Cela	76		121		200	

---

* LG - leaf growth

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 05-2 con't						
GRASSES						
1.Hija	304		307	200	160	100
2.Orhy	330		363	190	420	100
3.Sihy	228		284	180	355	70
FORBS						
1.Spam	406		505	330	470	90
Site 05-3						
SHRUBS						
1.Artr	101		223		233	
2.Chvi			149		204	
GRASSES						
1.Orhy	203		302	260	300	130
2.Hija	177		421	275	160	195
3.Sihy	228		308	250	305	110
Site 05-7						
SHRUBS						
1.Cost	50		87		101	
2.Epvi	76		♀ 35 ♂ 48		165	
3.Artr	76		170		202	
GRASSES						
1.Hija	203		245	330	200	135
2.Bogr	203		169	225	84	93
3.Sihy	254		247	146	236	70
FORBS						
1.Spam	254		281	202	235	50



LAS VEGAS DISTRICT

Symbol 1978	J 26	FEBRUARY				MARCH				APRIL				MAY				JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER				NOVEMBER			
SMD(From-To in cm)	S 30	5 30	S 30	S 30	1 30		S 30	S 30	2 30	1 30	1 30		5 30	S 30	4 30	8 30	14 30	18 30	19 30	22 30	D	D	D	D		D	D	D	D	D	D	D	D	D	D	S 30	5 30	S 30	12 30	S 30	S 30
Precip. (mm)									6	-	-		-	50				0	0	0	0	0	0	0		22	0	3	0	0	2	3	0	0	0	8	2	13	0	12	12
S.T.-°C			-		-									18	20	20	20	26	28	26	29	30	30	32		26	28	28	27	25	29	17	26	24	25	18	16	10	19	7	10
Las Vegas 5-1-1																																									
SHRUBS																																									
Amdu	LG								TG	BV			FG		1B	FB	BO SR	SR	SD			LY		LD													D				
Ladi	D							TG		BV			FG		1B	FB				BO		SR	SD									LY							LD		D
Dafr	D								LG		TG		BV		1B	FB				BO SR	SD								LY												
Grsp	D						LG		TG FB	BO					SR	SD	SD LY				LD															D					
	D						LG		TG FB	BO					SR	SD	LY				LD																				
GRASSES																																									
Hiri	D							GS	½V	FS			Ar					DS	HS	SD	BD								PD												
FORBS																																									
Spam	D						GS		FS					1B	FB		BO		SR	SR BD	DS BD	BD				PD											D				

Symbol 1978	J 26	FEBRUARY				MARCH				APRIL				MAY				JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER				NOVEMBER			
SMD (From-To in cm)	S 30	S 30	5 30	S 30	S 30		S 30	S 30	2 30	S 30	1 30		5 30	S 30	7 30	9 30	15 30	20 30	20 30	0	0	0	D	0		D	0	0	D	0	D	0	D	D	0	S- 5.	5 30	S 30	5 30	S 30	S 30
Precip. (mm)									3					81	0			0	0	0	0	0	0	0		55	1	3	0	0	3		0	0	0	5	1	21	0	37	25
S.T.-°C					-									19	20	30	28	29	-	30	30	31	28	28		26	34	28	29	29	32	17	22	28	24	18	12	12	16	0	0
Las Vegas 5-1-2																																									
SHRUBS																																									
Cora	D		LG						TG				FG	1B		FB	BO				SD										LY						LD	LG	LY	LD	0
Krpa	D								LG						TG	BV	1B	FB		BO		SR		SD								LY						LD	LG	TG	LY
Epne ♀	D		TG		BV								1B	SR					-			SD										LY					LD				0
♂	D		TG		BV								1B	FB	BO					SR		SD										LY					LD				D
GRASSES																																									
Hiri	D		GS								½V						FS	HO	An	DS	SD					BO								PD				½V			FS

Symbol 1978	J	FEBRUARY				MARCH				APRIL				MAY				JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER				NOVEMBER			
	26																																								
SMD(From-To in cm)	S 30	S 30	S 30	S 30	1 30		S 30	1 30	S 30	S 30	1 30		5 30	2 30	4 30	4 30	8 30	12 30	13 30	20 30	15 30	20 30	D	20 30		D	D	D	D	D	D	D	D.	D	D	S 30	5 30	S 30	5 30	S 30	S 30
Precip. (mm)									12	-	-		-	91	0	-	-	0	0	0	0	0	0	0		13	0	13	0	0	2	16	0	0	0	12	1	16	0	50	25
S.T.-°C			-		-									18	21	20	24	23	32	24	27	31	24	24		26	27	27	26	27	20	18	22	18	23	14	4	8	6	0	0
Las Vegas 05-2																																									
SHRUBS																																									
Arsp	D	LG							BV	FG			1B		FB			BO	SR	SD	LY		LD															D			
Grsp	D						LG		BV	TG FG			FB	BO				SR	SD		SD LY	LY		LD														D			
Cela	D								LG	TG						BV	1B			FB	BO						SR									SD		SD LY			LD
GRASSES																																									
Hija	D			GS												FS	HO	An	DS		SD		BD								PD		GS			½V			BD	PD	D
Orhy	D			GS						½V					FS		HO	An	DS	HS	SD BD		BD								PD		GS			½V				BD	PD
Sihy	D	GS							½V							FS	HO	An	DS		SD		BD					PD					GS			½V				HO	SD
FORBS																																									
Spam	D						GS							FS		1B		FB		BO	SR	DS		BD			PD						GS						PD	D	

Symbol 1978	J 26	FEBRUARY				MARCH				APRIL				MAY				JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER				NOVEMBER			
SMD(From-To in cm)	S 30	S 30	S 30	S 30	1 30		S 30	S 30	1 30	S 30	1 30		5 30	1 30	4 30	9 30	11 30	10 30	18 30	18 30	15 30	21 30	D	10 30		D	D	D	D	D	D	D	D	D	D	S 30	2 30	S 30	2 30	S 30	S 30
Precip. (mm)									14	-	-		-	25	0	-	-	0	0	0	0	0	0	0		23	1	0	0	0	6	28	0	0	0	12	8	31	0	50	50
S.T.-°C					-									12	20	20	19	30	30	22	30	31	24	24		27	30	29	30	29	16	17	20	14	20	14	4	8	2	0	0
Las Vegas 05-3																																									
SHRUBS																																									
Artr	D							LG	TG												BV							FG	1B							FB	BD	SR	SD		SD LY
Chvi	D							LG			TG					BV								FG		1B		FB			BO		SR			SD		SD LY			SD LY
GRASSES																																									
Hija	D							LG										HO	An	SD		SD BD	BD								PD	GS				½V				SD	D
Orhy	D						GS			½V						FS		HO	An	DS	SD	SD BD	BD								PD		GS			½V				SD	D
Sihy	GS									½V						FS	HO	AN		DS	SD	SD BD				PD							GS			½V				HO	D
FORBS																																									

Symbol 1978	J 26	FEBRUARY				MARCH				APRIL				MAY				JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER				NOVEMBER			
SMD(From-To in cm)	S 30	5 30	5 30	S 30	1 30		S 30	S 30	1 30	S 30	1 30		5 30	1 30	4 30	9 30	14 30	15 30	15 30	16 30	10 30	15 30	18 30	D		D	D	D	D	D	D	D	D	D	D	12 30	2 30	s 30	5 30	fr	S 30
Precip. (mm)									12					126	0			0	0	0	0	0	0	0		0	1	4	0	0	8	27	0	0	0	12	6	33	0	62	50
S.T.-°C			-		-									14	20	21	22	28	30	28	28	31	24	23		30	34	29	28	30	18	17	22	16	22	24	10	10	4	0	0
Las Vegas 05-7																																									
SHRUBS																																									
Cost	D								LG	TG					BV	1B	FB		BO				SR	SD									LY						LD		
Epvi	D								BV					TG					1B	FB BO		BO	SR	SD									LY						LD		
Artr	D							LG	TG												BV								FG				1B			FB		BO	SR	SD	SD LY
GRASSES																																									
Hija	D						GS										FS	HO	An	DS	SD		BD									GS			½V			An	DS		BD
Bogr									GS												½V BD		½V	BD								GS		½V				FS	HO		D
Sihy	D		GS								½V						FS	HO	An		SD		BD				PD							GS		½V			BD		
FORBS																																									
Spam	D								GS							FS	1B		FB		DS	DS BD	BD				PD							GS					BD		PD

BATTLE MOUNTAIN

BATTLE MOUNTAIN

After three years, patterns of growth and development continue to exhibit considerable variability. Further evidence is given of the general relationship between variables such as soil moisture depth and phenological development.

Figures 1 through 3 suggest that in spite of phenodynamic variability, certain similarities in development tend to occur. For example, the onset of full bloom in desert globemallow (*Sphaeralcea ambigua*) begins within a two week period when all years are compared (Figure 1). Arrowleaf balsamroot (*Balsamorhiza sagittata*) is similar (Figure 1), with both the start of growth and full bloom occurring within a narrow time frame (less than two weeks). For halogeton (*Halogeton glomeratus*; Figure 1), the pattern is not so straightforward. A possible reason, of course, is that halogeton is annual, while the other two species are perennials.

For selected shrubs (Figure 2), there is greater variability of phenophase occurrence than for the forbs and/or grasses. It is possible that the onset of growth in these shrubs is highly temperature-dependent. Further data analyses with attempted correlations between development and climatic factors must be attempted.

The grasses seem to be intermediate in variability between shrubs and forbs. In 1976, the period of $\frac{1}{2}$ vegetative growth was considerably later than in 1977 and 1978 (where this period is relatively close) for all three grasses

(Figure 3). This, of course, may be the result of a late start in data gathering during the spring of 1976. Perhaps a safer comparison for all three groups, i.e., grasses, forbs, and shrubs, would be to compare only later phenophases. In this case, both squirreltail grass (Sitanion hystrix) and bluebunch wheatgrass (Agropyron spicatum) reach a dry state within one or two weeks when comparing the three years. For Indian ricegrass (Oryzopsis hymenoides), dryness was apparent four weeks earlier in 1976. It is of interest to note that seed dissemination took place, or at least began, two to three weeks later in 1977 (wet growing season) than either 1976 or 1978 (drier growing seasons) for both squirreltail grass and Indian ricegrass. This data substantiates a trend noticed last year - that plants tend to mature earlier under drier conditions. However, this pattern did not occur for bluebunch wheatgrass. Such data may be of important application in the timing of heavy grazing in an intensive grazing management system.

The phenodynamic of bluebunch wheatgrass compared for three years (Figure 4) was surprisingly similar. This attests to the general stability and desirability of this excellent grass. The closeness of development among the three years suggests the value of this species as an indicator for range readiness and range condition.

A salt desert shrub species such as bud sagebrush (Artemesia spinescens) shows greater variability (Figure 5). However, in Figure 5 there is an apparent relationship between onset of phenophase and soil moisture depth.

Indian ricegrass (Figure 6) seems quite similar when comparing 1976 and 1978, but for reasons not clear in this data, flower stalks appeared later in 1977.

Figure 7 does not offer any compelling reason for a lack of correlation between height growth and soil moisture depth. The interaction with both soil and air temperature is not recorded and, of course, may be influential in this seeming lack of a strong relationship. However, there seems to be a somewhat better relationship when this same data is evaluated for rabbitbrush (Chrysothamnus viscidiflorus; Figure 8). The shorter leader growth seems to be somewhat related to shallower soil moisture during early spring growth.

Table 1 shows leader (shrubs) and height (grasses) growth for the three years. None of the years appeared to be a better growth year than the others.

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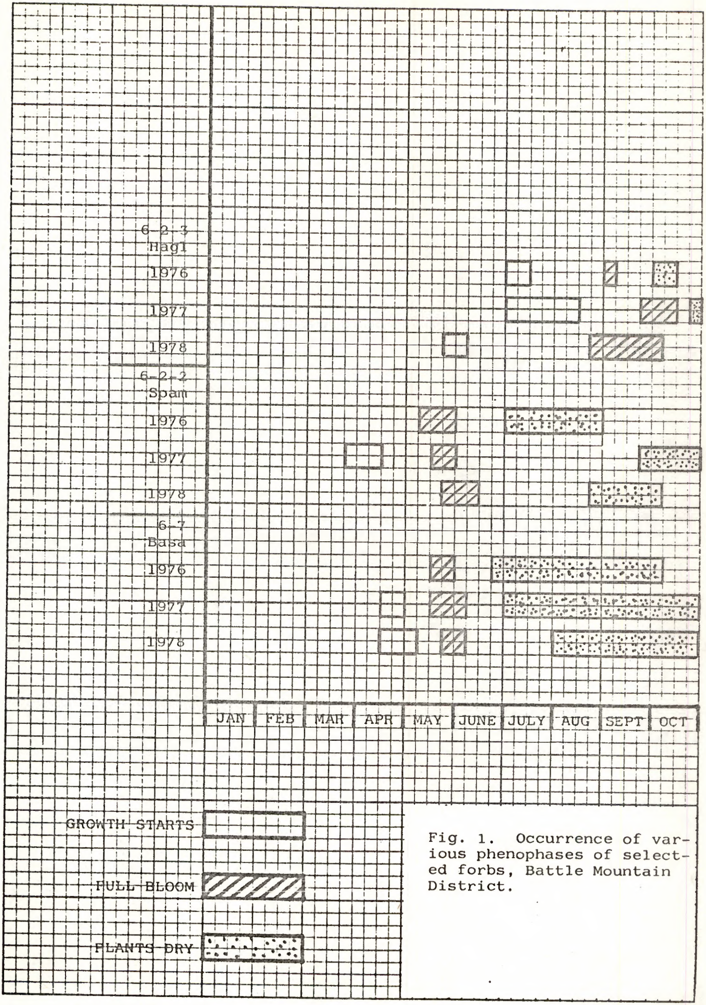

Fig. 1. Occurrence of various phenophases of selected forbs, Battle Mountain District.

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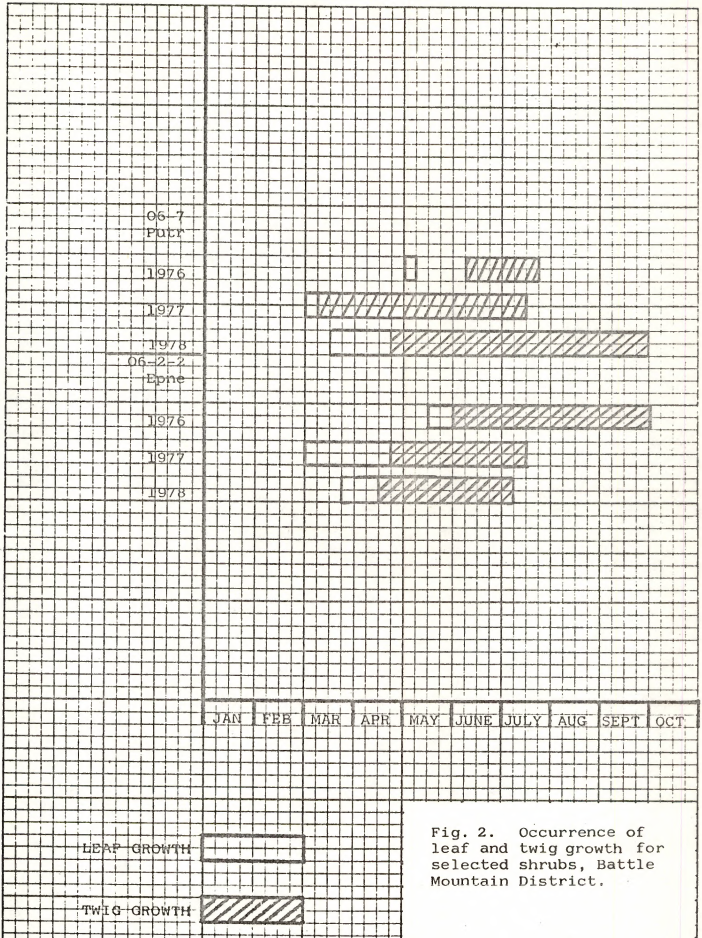

Fig. 2. Occurrence of leaf and twig growth for selected shrubs, Battle Mountain District.

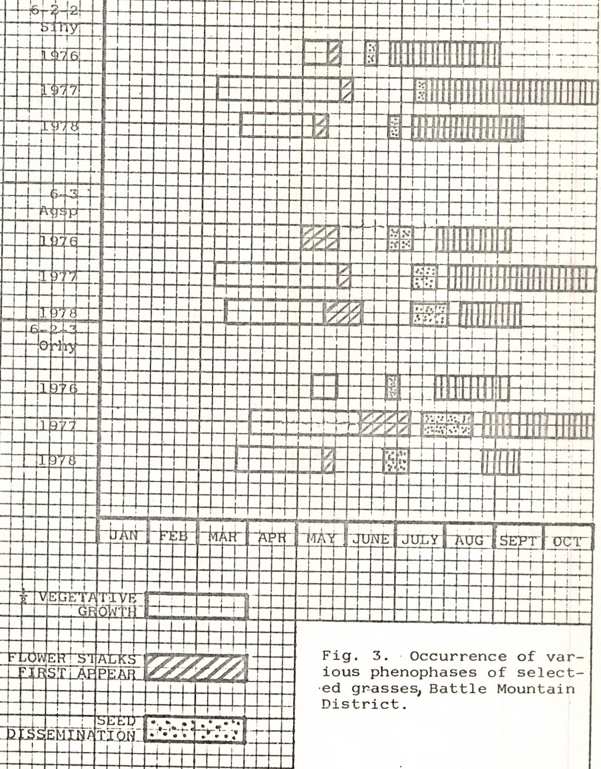

Fig. 3. Occurrence of various phenophases of selected grasses, Battle Mountain District.

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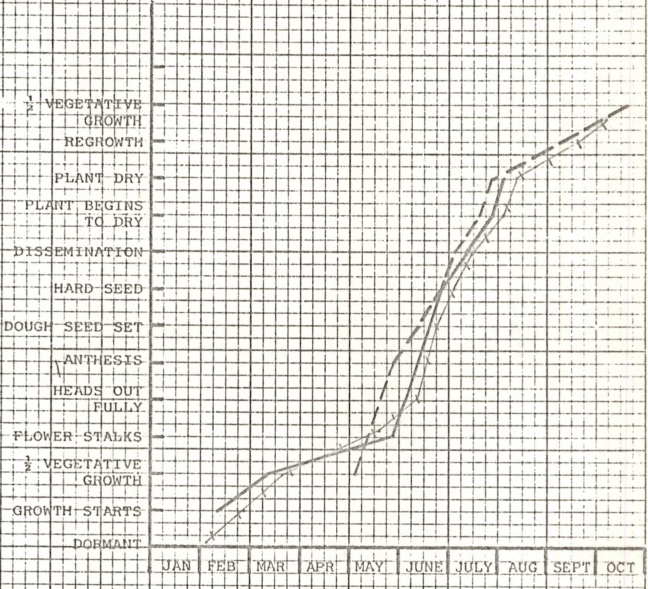

Fig. 4. Phenology of Agropyron spicatum on northern desert shrub vegetation type (site 06-3), Battle Mountain District.

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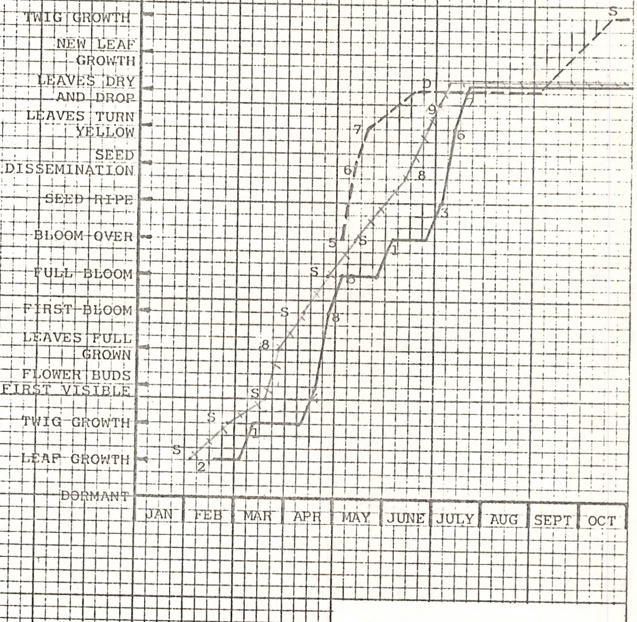

Fig. 5. Phenology of Artemisia spinescens compared with soil moisture depth (inches) on salt desert shrub vegetation type (site 06-2-2), Battle Mountain District.

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EUGENE DIETZGEN
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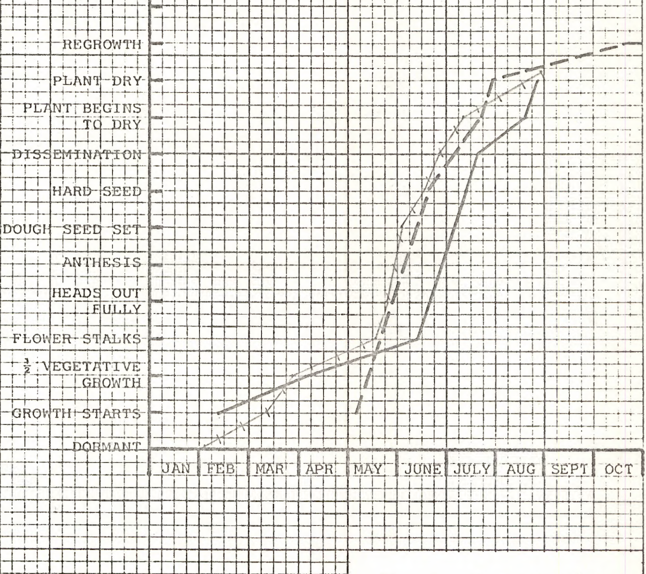

Fig. 6. Phenology of *Oryzopsis hymenoides* on salt desert shrub vegetation type (site 06-2-3), Battle Mountain District.

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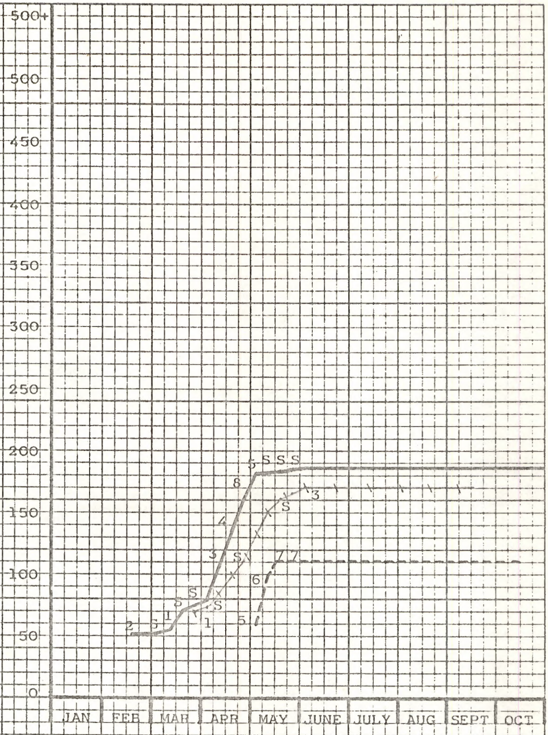

Fig. 7. Height growth (mm) of Sitanion hystrix compared with soil moisture depth (inches) on salt desert shrub vegetation (site 06-2-2), Battle Mountain District.

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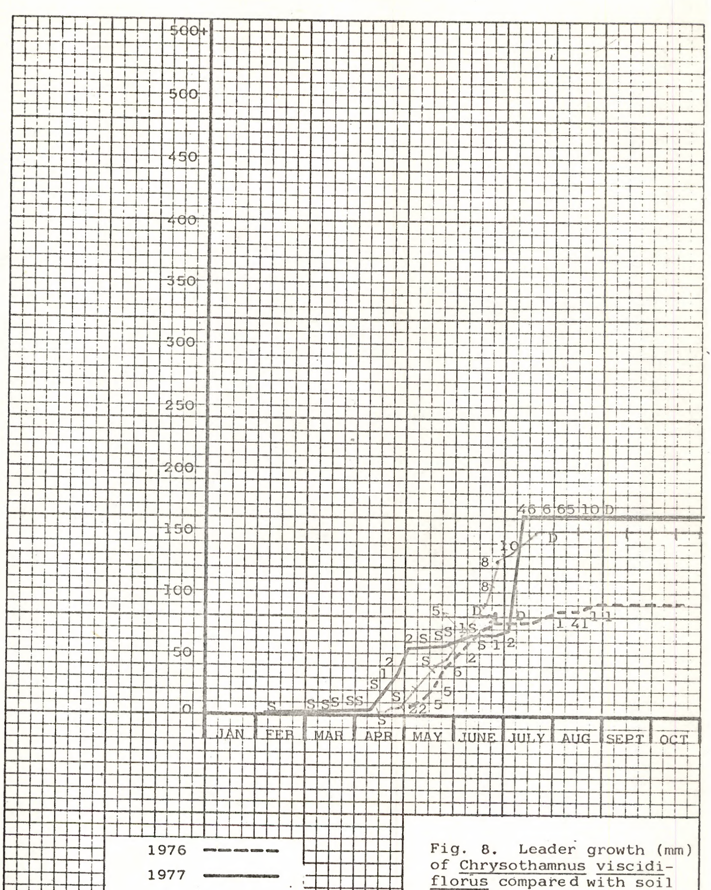


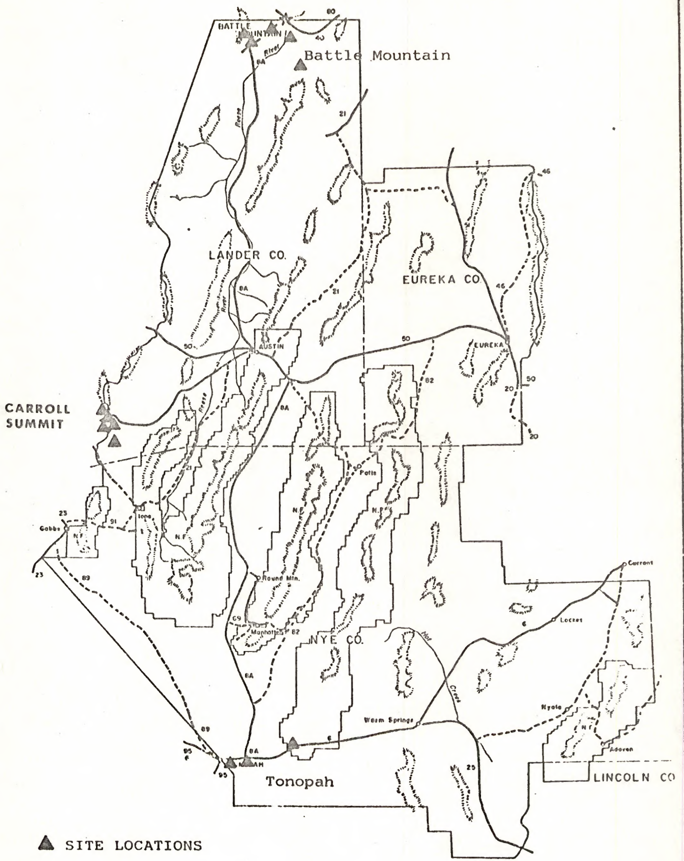
Fig. 8. Leader growth (mm) of Chrysothamnus viscidiflorus compared with soil moisture depth (inches) on mountain brush vegetation (site 06-7), Battle Mountain District.

Table 1. Leader (Shrubs) and Height (Grasses) Growth in the Battle Mountain District for 1976, 1978, and 1978.

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 06-2-1						
SHRUBS						
1.Tegl	64		66		105	
2.Chna	283		130		185	
3.Save	127		70		122	
4.Atco	120		75		125 ♀ 110 ♂	
GRASSES						
1.Elci	584		1100		765	
2.Spai	416		500		270	15
Site 06-2-2						
1.Arsp	36	42	19		50	
2.Atco	48		50		160 ♀ 154 ♂	
3.Epne	204		120		180	
4.Grsp	33		90		165	
GRASSES						
1.Brte	145		140		100	70
2.Sihy	113	73	185		170	105
3.Posa	145	81	160		62	50
FORBS						
1.Sphae sp.	130	103	175		102	40
2.Lomat sp.					60	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 06-2-3						
SHRUBS						
1.Cela	70				215	
2.Atco	65				155	
3.Grsp	25	20			168 ♀ 160 ♂	
4.Arsp	20	12			52	
GRASSES						
1.Sihy	178				170	70
2.Orhy	150				360	170
3.Brte	145	55			130	50
FORBS						
1.Sphae sp.	200				80	
2.Hagl	155				175	
Site 06-3						
SHRUBS						
1.Arar	62		30		188	
2.Eriog sp.	65		46		100	
3.Chvi	86		75		158	
4.Pran	97		25		110	
GRASSES						
1.Posa	205		65		94	80
2.Sihy	279		185		215	105
3.Agsp	437		500		375	200
4.Brte	90		56		100	105
FORBS						
1.Crac	90		85		125	
2.Zigad sp.	381		240		255	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 6-3 con't						
FORBS						
3.Phlox sp.	13		15		52	16
4.Lomat	90				75	
5.Astra sp.	25		68		150	
6.Eriog sp.			4		55	
7.Alliu sp.					100	
Site 06-7						
SHRUBS						
1.Putr	76		40		185	
2.Chvi	92		165		138	
3.Eriog sp.	89		40		110	
4.Artr	154		65		255	
5.Pran	74		65		145	
GRASSES						
1.Agsp	383		310		313	165
2.Posa	175		200		100	90
3.Sihy	251		225		210	135
4.Brte	125		60		108	50
5.Astra sp.			90		80	
6.Agros sp.					110	



BATTLE MOUNTAIN DISTRICT

SYMBOL 1978	FEB 28	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV 16	
SMD(From-To in cm)	S 60	S 60	S 60	S 60	2	S 60	2 60	2 60	S 60		5 60	5 60	S1 10 60	5 60	7 60	15 60	15 60	15 60	15 60	17 60		20 60	20 60		20 60		S 60	S 60		5 60	15 60		22 60		
Precip. (mm)						4	31	44	56		10	0	1	0	0	13	0	0	0	0		23	0		0		31	18		0	0		0		
S.T. (°C)			2	45		7	9	7	11		9	17	7	10	14	16	15	14	16	18		22	20		16		14	11		12	12		7		3
Battle Mtn. 06-2-1																																			
SHRUBS																																			
Tegl	D			LG				TG			BV					FB	BC	SR	SD	LY		LD													
Chna	D						LG	TG							FG			BV		1B		FB	BO					SD			LY				LI
Save	D			LG			TG				BV			FG														LY		LD					
Atco ♀	D			LG		TG					BV		1B		FB	BO			SD			LY	LY		LD			LD							
♂	D			LG		TG					BV		1B		FB	SR			LY			SD	LY		LY			LD							
GRASSES																																			
Elci	D		GS	½V									FS			An	DS			HS		SD	BD							PD					
Spai	D					GS					½V					HO		An	HS	SD					BD					GS			PD GS		PI

SYMBOL 1978	FEB 28	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV 16	
SMD(From-To in cm)	S 60	S 60	S 60	S 60	2 60	S 60	S 60	S 60	S 60		S 60	7 60	S5. 10 60	7 60	20 60	22 60	22 60	22 60	D	D		D	D		D		7 14	15 21		10 20	15 20		15 20		
Precip.(mm)						13	20	11	26		13	0	7	0	0	1	0	0	0	0		2	0		0		31	11		0	0		0		0
.T.-°C			11	8		7	13	9	15		14	18	8	16	20	18	19	22	21	20		24	22		22		18	10		12	12		7		1
attle Mtn. 6-2-2																																			
HRUBS																																			
rsp	LG* TG			BV	FG		1B		FB		BO				SD		LY	LD																	
tco ♀	D			LG	TG						BV			BO	SR	SR		SD				LY					LD								
♂	D			LG	TG						BV			BO	BO	LY		LY				LD					LD								
pne	D				LG			TG			BV				1B	BO		SR	SD						LY										
rsp	D			LG	TG	BV			1B		BO			SR			SD		LY				LD												
RASSES																																			
rte	D* GS				½V						HO		An		DS	SD	BD	PD										GS		½V					PD
ihy	GS*				½V						FS	HO			DS	HS	SD	BD	PD									½V							PD
osa	D* GS				½V			FS			HO		An		DS	SD	BD		PD									GS		½V					PD
ORBS																																			
phae sp.	D				FS			1B					FB			BO	SR		DS			BD			PD						GS				PD
omat sp.	D				FS	1B					FB					BO	BD	PD																	
henotype rom Feb.9,1978																																			

SYMBOL 1978	FEB 28	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV 16	
SMD(From-To in cm)	S 60	S 60	S 60	S 60	2 60	S 60	2 60	2 60	S 60		2 60	5 60	S2. 10 60	7 60	17 60	20 60	20 60	20 60	22 60	25 60		D	D		D		S 20	S 20		40 60	15-20. 40-60		40 60		
Precip. (mm)						10	23	13	19		3	0	4	0	0	1	0	0	0	0		8	0		0		6	10		0	0		0		0
S.T.-°C			17	13		9	16	11	14		17	19	9	14	20	20	19	24	22	22		24	23		19		15	10		12	13		8		4
Battle Mtn. 06-2-3																																			
SHRUBS																																			
Cela	D		LG				TG	FG	BV						1B	BO		SR	SD						LY		SD LY				LY				
Atco	D		LG				TG		FG		BV				1B	SR	SD					LY					LD								
Arsp	LG*	TG		BV				FG 1B			BO				SR	LY		LD																	
Grsp	D		LG		TG		BV	1B			FB	BO	SR			SD						LY					LD								
	D		LG		TG		BV		1B			FB	BO				LY					LD													
GRASSES																																			
Sihy	GS*				½V						FS		HO		DS		SD		BD			PD						GS		½V					PD
Orhy	D		GS		½V							FS	HO	DS		HS	SD		BD						PD			GS		½V					PD
Brte	D* GS				½V						HO			An	DS	HS	SD	BD	PD									GS			½V				PD
FORBS																																			
Hagl	D												GS		FS										FB						SR		DS		PD
Sphae sp.	D			GS				FS				1B	FB			BO	SR		DS			BD	PD												
Phenotype from Feb. 9, 1978																																			

SYMBOL 1978	FEB 28	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV 1	
SMD(From-To in cm)	S 25	S 25	S 25	S 25	2 25	S 25	S 60	S 60	S 60		2 60	S 60	S5 10 60	2 60	12 60	20 60	20 60	25 60	D			D	D		D		S 30	S 30		10 30	20 30		12 20 30		
Precip.(mm)						7	11	5	25		21	0	9	0	0	3	0	0	0	0		7	0		0		33	16		0	0		1		
S.T.-°C			6	4		6	6	sn	13		10	17	5	12	19	18	16	17	20	18		22	22		19		15	10		12	11				2
Battle Mtn. 06-3																																			
SHRUBS																																			
Arar	D				LG	TG									FG		BV		1B				BO					SR			SD				LI
Eriog sp.	D			TG									BV			1B	FB	BO					SR					SD			LY				LD
Chvi	D			LG	TG										FG	BV		1B	FB				BO		SR			SD							L
Pran	D					LG	TG	BV			1B	FB	BO			SR							SD					LY							L
GRASSES																																			
Posa	D* GS			½V							FS	HO			An	SD		BD	PD									½V							PI
Sihy	GS*			½V								FS			HO	DS	SD	BD		PD								½V							PI
Agsp	D* GS			½V								FS			HO	DS		HS	SD			BD	PD					GS							PI
Brte	D* GS			½V								FS	HO		An	HS	SD	BD	PD									GS							PI
FORBS																																			
Eriog sp.	D				GS						1B			FB			SR	DS		BD		PD													
Phlox sp.	D			GS					FS			FS			BO	DS	BD			PD										GS					P
Astra sp.	D				GS	FS			1B				FB	SR		DS	BD	PD																	
Zigad sp.	D* GS										FS	1B		FB	BO	DS	BD	PD																	

*Phenotype from Feb 9

SYMBOL 1978	FEB 28	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NO 16
attle Mtn. 6-3 con't																																		
ORBS																																		
rac	D				GS							FS	1B	FB		BO	DS	BD				PD												
lliu sp.	D				FS							1B		FB		BO	PD																	
omat sp.	D				FS	1B	FB					BO	SR			DS	BD	PD																
enotype rom Feb.9,1978																																		

SYMBOL 1978	FEB 28	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV 16	
SMD(From-To in cm)	S 20	S 20	S 20	S 20	S 20	S 60	S 60	S 60	S 60		2 60	S 60	S 60	12 60	12 60	20 60	20 60	25 60	D	D		D	D		D		S 30	S 30		7 30	15 30	20 30			
Precip.(mm)						15	19		24		4	0	9	0	0	3	0	0	0	0		0	0		0		33	10		0	0	0			
S.T.-°C			11	9		8	12	12	13.5		15	17.2	7	12	16	17	23	17	26	24		30	20		19		15	7		11	12	8			
Battle Mtn. 06-7																																			
SHRUBS																																			
Putr	D			LG					TG BV				1B		FB	BO		SR				SD	FG SD								LY				
Chvi	D			LG			TG								FG		BV		1B				FB					BO		SR		SD			L
Eriog sp.	D						LG				TG				BV		1B		FB			BO			SR					SD					L
Pran	D					LG		TG BV				FB	BO			SR									SD					LY					L
Artr	D			LG		TG									FG		BV		1B				FB		BO			SR							S
GRASSES																																			
Agsp	D			GS							½V		FS			An	DS	HS		SD		BD					PD	GS		½V					P
Posa	D* GS							½V						HO	An	HS		BD		PD								½V							P
Sihy	GS*				½V								FS		HO	DS		SD	BD			PD						GS		½V					P
Brte	D	GS						½V					FS	HO	An	DS	SD	BD	PD											GS	½V				P
FORBS																																			
Phlox sp.	D				GS				1B				FB			BO	SR	BD				PD						GS							P
Lupin sp.	D							FS					1B		FB	BO		SR				DS			BD		PD								

*Phenotype from Nov. 9, 1978

SYMBOL 1978	FEB 28	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV 16
Battle Mtn. 06-7 con't										
Basa	D		GS	FS 1B FB	BO SR DS	BD	PD			
Eriog sp.	D		GS	FS	1B FB BO	DS BD PD				
Astra sp.	D			1B BO	SR BD PD					
Agros sp.	D	GS		FS	1B SR DS	BD PD				

*Phenotype from Feb. 9,1978

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With addition of the 1978 data, the annual phenodynamic comparisons show a rather marked similarity. Deviations in the case of the grasses are closely related to soil moisture depths (Figure 1). Also of note is the shape of the grass curves (Figure 2), which suggest longer time periods for the vegetative phenostages when compared with the reproductive phenophases. For Indian ricegrass (Oryzopsis hymenoides; Figure 1) and squirreltail grass (Sitanion hystrix; Figure 2), the reproductive phenophases average five and six weeks, respectively. Information on those time periods will be useful for intensive grazing management systems.

For the forb desert globemallow (Sphaeralcea ambigua, Figure 3) and the shrub budsage (Artemisia spinescens; Figure 4), the phenodynamic curves show greater annual variability. In fact, the curves tend to cross over from year to year. The reasons are not clear for this phenomena.

Leaf and twig growth data is easy to plot, but difficult to interpret. The data for black sagebrush (Artemisia nova) suggest a relatively long leaf growth period relative to twig growth. The other two species plotted in Figure 5, Nevada ephedra (Ephedra nevadensis) and shadscale (Atriplex confertifolia), have a much larger ratio of leaf/twig growth.

The grass data is quite variable (Figure 6). The ratio of vegetative to reproductive values is of interest. For both grasses plotted in Figure 6, the vegetative growth period is greater than the period of growth of the flower stalks.

The height growth of squirreltail grass (Figure 8) appears to be strongly regulated by soil moisture depth. However, the relationship of soil moisture depth and leader growth of Nevada ephedra (Figure 7) is not as clearly defined.

Leader growth (shrubs) and height growth (grasses) appear to be greater in 1976 than in 1977 or 1978. It is interesting to note that 1978 is the only year that showed any regrowth at all (Table 1).

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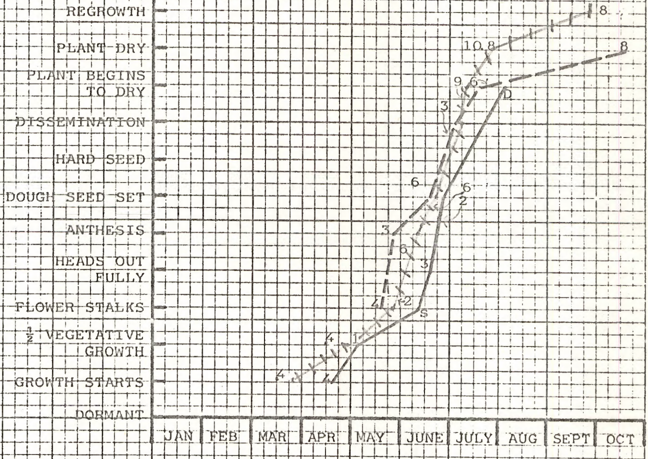

Fig. 1 . Phenology of Oryzopsis hymenoides compared with soil moisture depth (inches) on a salt desert shrub vegetation type (site 06A-2-1), Tonopah District.

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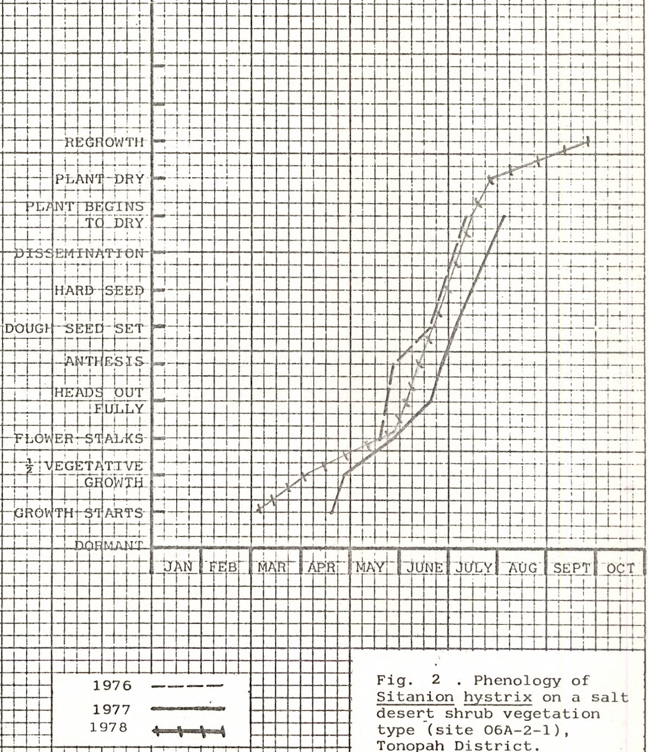

Fig. 2 . Phenology of Sitanion hystrix on a salt desert shrub vegetation type (site 06A-2-1), Tonopah District.

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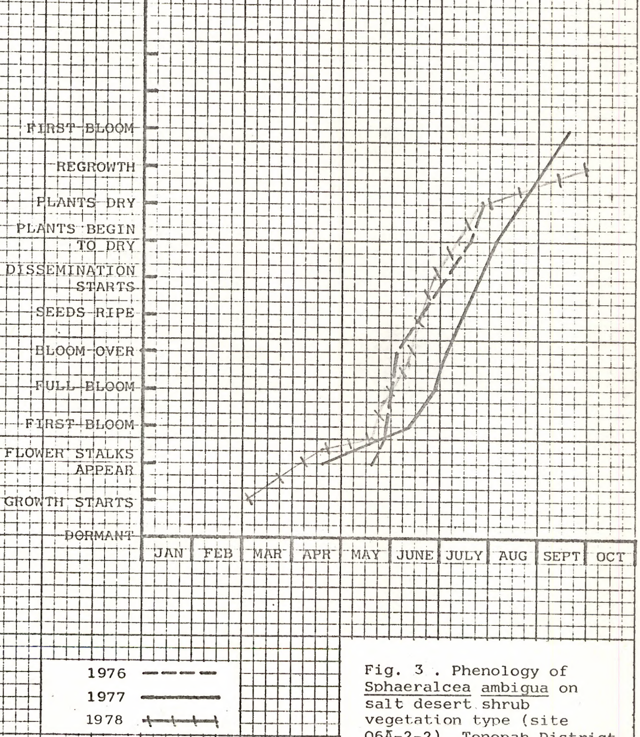

Fig. 3 . Phenology of *Sphaeralcea ambigua* on salt desert shrub vegetation type (site 06A-2-2), Tonopah District.

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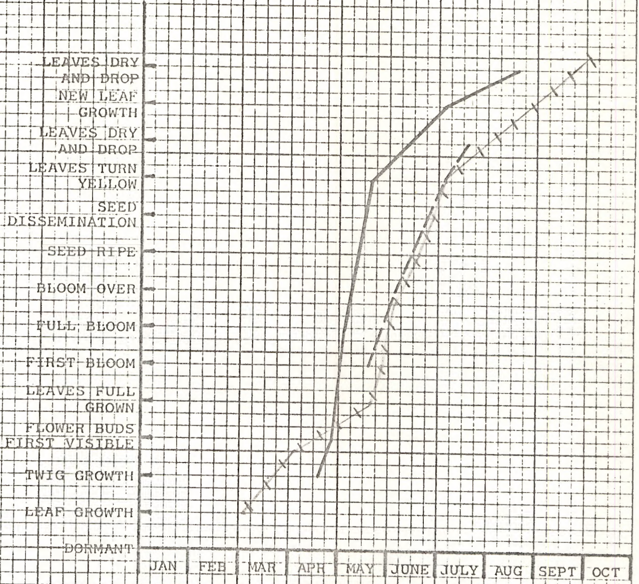

Fig. 4 . Phenology of Artemisia Spinescens on salt desert shrub vegetation type (site 06A-2-1), Tonopah District.

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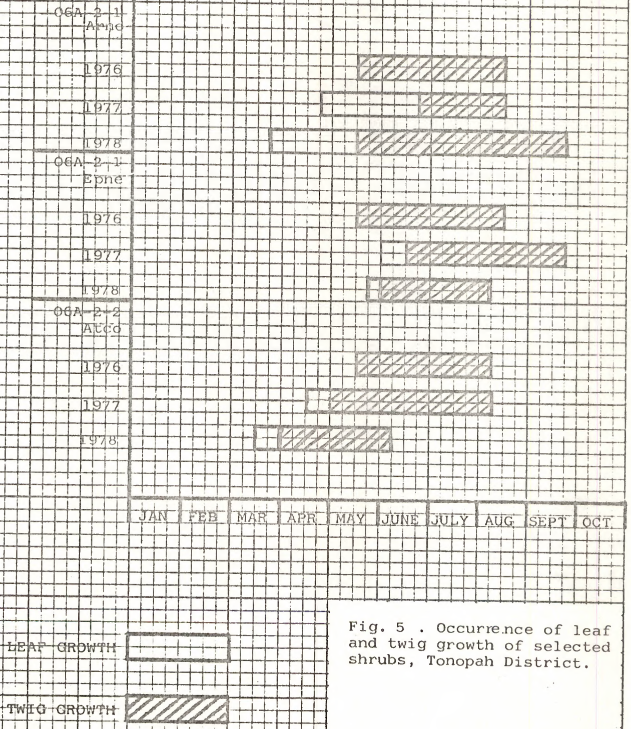

Fig. 5 . Occurrence of leaf and twig growth of selected shrubs, Tonopah District.

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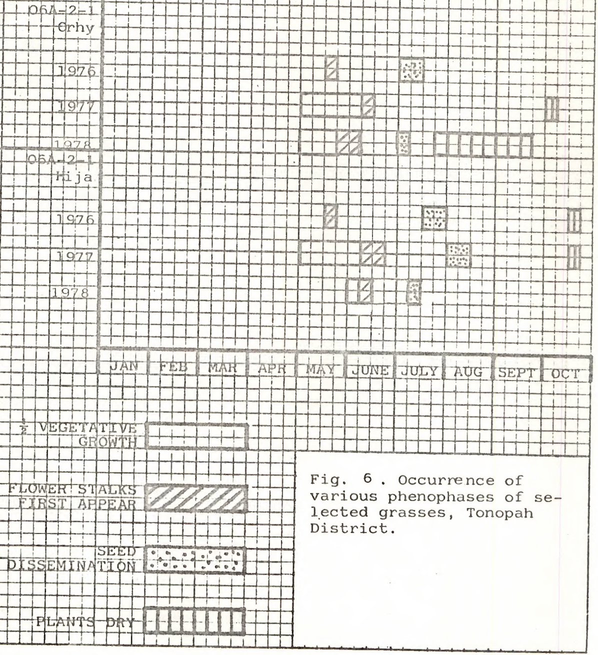

Fig. 6 . Occurrence of various phenophases of selected grasses, Tonopah District.

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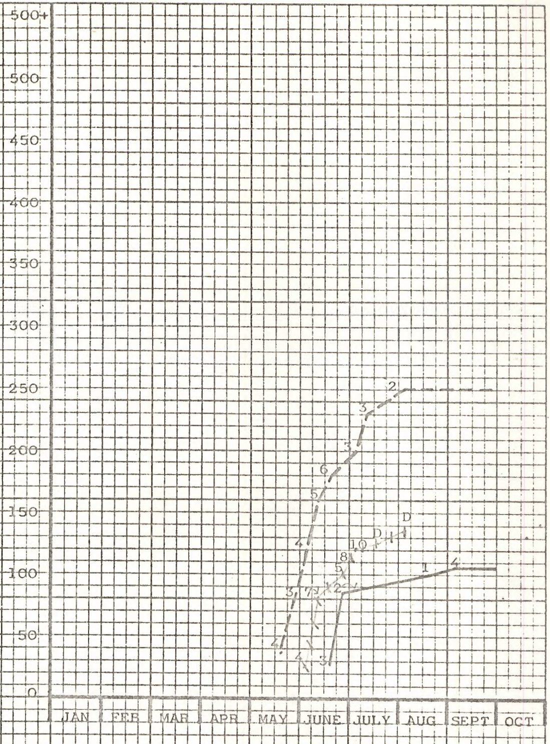

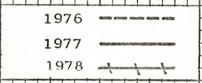

Fig. 7 . Leader growth (mm) of Ephedra nevadensis compared with soil moisture depth (inches) on a salt desert shrub vegetation type (site 06A-2-1), Tonopah District.

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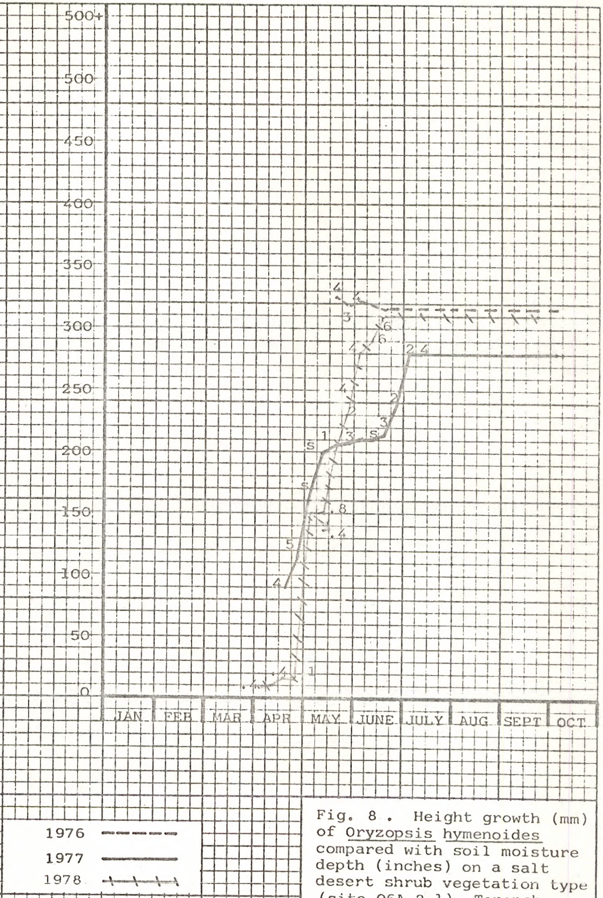


Fig. 8 . Height growth (mm) of Oryzopsis hymenoides compared with soil moisture depth (inches) on a salt desert shrub vegetation type (site 06A-2-1), Tonopah District.

Table 1. Leader (Shrubs) and Height (Grasses) Growth in the Tonapah District for 1976, 1977, and 1978.

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 06A-2-1						
SHRUBS						
1.Arno	230		200		220	
2.Arsp	30		20		23	
3.Atco	60		60		87	
4.Cela	170		45		23	
5.Epne	250		105		135	
6.Grsp	110		60		70	
GRASSES						
1.Hija	340		330		105	52
2.Orhy	324		280		310	97
3.Sihy	400		290		400	140
FORBS						
1.Sphae sp.	450		340	110	440	30
Site 06A-2-2						
SHRUBS						
1.Atco	70		70		155	
2.Arsp	40		20	2	43	LG*
3.Cela	235		180		180	
GRASSES						
1.Orhy	314		260		367	145

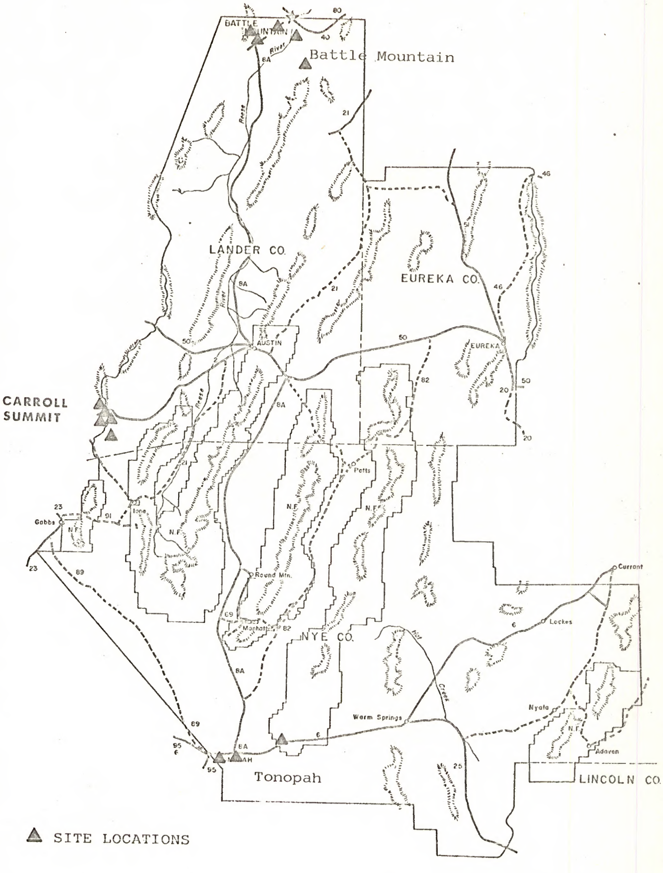
---

*LG=leaf growth

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 06A-2-2 con't						
FORBS						
1.Spam	500		310	310	440	GS*
Site 06A-3						
SHRUBS						
1.Artr	220		125		180	
2.Come	120		75		90	

---

*GS= growth starts



BATTLE MOUNTAIN DISTRICT

SYMBOL 1978		MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)		S 60	25 60	25 60	12 60	12 60	12 60	12 60	25 60	12 60	2 60	5 60	6 60	10 61	17 61	16 61	20 60		D	D	D	D	D	22 64		D		12 43	10 61		10 61			11 61	S 6
Precip. (mm)						13	7	8	0	20	0	0	0	0	0	0	-	-	-	-	-	-		47		-			0						
S.T. ($^{\circ}$C)				12	11	11	14	13	12	14	19	25	19	20	25	21	21	23	23	27	27	27		25		21		8	22		20			8	3
TONOPAH 06A-2-1																																			
SHRUBS																																			
Arno		D			LG							TG					BV	FG											1B		FB			SD	LY
Arsp		LG				BV						FG	FB	BO		SR	SD	LY													LD				
Atco ♀		D		LG		TG						BV	1B	BO	BO					SR														SD	
♂		D		LG		TG						BV	1B	FB	BO					LY													LY		
Cela		D		LG									TG					BO																	SD
Epne		D											LG	TG		BV			SR			SD		LY											
Grsp ♀		LG							TG				BV	1B			1B		SD			LY									LD				
♂		LG							TG				BV	1B			BO		LY			LY									LD				
GRASSES																																			
Hija		D									GS			$\frac{1}{2}$V	FS	An			SD	BD									GS						
Orhy		D			GS					$\frac{1}{2}$V			FS		An	DS	HS	SD	BD		PD								GS						
Sihy		GS				$\frac{1}{2}$V							FS	HO	An	DS		SD	BD		PD								GS						
FORBS																																			
Spam		GS									FS		1B	FB	BO		DS		BD			PD							GS						

SYMBOL 1978		MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm.)		S 60	12 60	25 60	12 60	12 60	12 60	12 60	25 60	12 60	2 60	5 61	75 61	10 61	23 61	23 61	20 60	25 60	D	D	D	D		D		D		12 34	5 51		22 60			23 60	1 5
Prec(mm)						–	–	–	–	–	–	–	–	–	–	0	–	–	–					0		–		–	–		–				
ST (°C)				14	12	11	15	15	13	13	19	23	19	22	26	21	23	23	28	27	29			25		20		10	22		20			10	
Tono.06A-2-2																																			
SHRUBS																																			
Cela		LG						TG					BV	FB	BO			SR																SD	L
Arsp		LG				TG BV				1B			BO		SD		LY	LD													LG				
Atco ♀		D		LG		TG						BV	1 B	FB	SR	SR						SD													
♂		D		LG		TG						BV	FB	BO	BO	LY						LY													
GRASSES																																			
Orhy		D	GS				½V					FS		HO	HS	SD	BD			PD									GS						
FORBS																																			
Sphae sp.		GS						FS				1B	FB		BO	SR	DS		BD		PD								GS						

SYMBOL 1978		MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm.)		S 60	S 60	12 60	S 60	12 60	12 60	12 60	25 60	S 60	2 60	76 61	76 61	10 61	25 61	25 61	17 60	20 61	23 30	25 30	28 30	10 61		25 60		38 61		12 40	10 61		9 61			11 61	1 6
Prec(mm)						18	7	16	0	28	–	–	0	0	0	0		–	–					25		–		16	0		–			–	
ST(°C)				12	12	11	16		15	15	17	24	18	23	25	21	27	24	24	27	27	31		25		20		9	23		21			10	4
Tono. 06A-2-3																																			
SHRUBS																																			
Artr		D										TG					BV			FG									1B		FB			BO	LY
Come		D										LG	BV		FB				BO		SR			SD	LY										
GRASSES																																			
FORBS																																			

CARROLL SUMMIT

CARROLL SUMMIT

Several species on the Carroll Summit sites went directly from "growth starts" to "dry" without progressing through reproductive phenophases. The most interesting species was shadscale (*Atriplex confertifolia*) on the salt desert shrub site (07-2). This species is dioecious, and female plants progressed through all phenophases, but the male plants did not. Other species not having reproductive phases include tapertip hawksbeard (*Crepis acuminata*; site 07-3), Thurber needlegrass (*Stipa thurberiana*; site 07-7), goosefoot violet (*Viola purpurea*; site 07-7), groundsel (*Senecio* sp.; site 07-7), and pale agoseris (*Agoseris glauca*; site 07-7). The last four species all occurred on the mountain brush site.

The Carroll Summit vegetation showed strong leaf, culm, and leader growth relatively early in the spring. This growth occurred prior to a reasonably heavy storm during the third week in April, and must therefore be a result of wet soils resulting from snow melt or earlier storms. Good grass growth appears to be related to the April storm. Growth of species on the mountain brush site started immediately after snow melt. The three year comparison of leader and height growth data (Table 1) reveals no striking patterns, although some species showed greater growth in 1978. Some of the most noticeable species in this regard are fairway wheatgrass (*Agropyron cristatum*; site 07-3), squirreltail grass (*Sitanion* hystrix; sites 07-6 and 07-7), groundsel (Senecio sp.; Site 07-6), Kentucky bluegrass (Poa pratensis; Site 07-6), and desert globemallow (Sphaeralcea ambigua; Site 07-2).

The start of growth for squirreltail grass varied considerably from year to year (Figure 1), as did the height growth of fairway wheatgrass, which grew the tallest in 1978 as indicated above (Figure 2).

The phenology of Kentucky bluegrass in a mountain meadow is characterized by regrowth periods in 1976 and 1977, but not 1978 (Figure 3). Longflower snowberry (Symphoricarpos longiflorus) phenology was very similar all three years (Figure 4). Sandberg bluegrass (Poa sandbergii) phenology showed greater variation with considerably later development in 1978 (Figure 5).

Leader growth of antelope bitterbrush (Purshia tridentata) was much earlier and longer in 1976 than either 1977 or 1978 (Figure 6). This does not necessarily appear to be related to soil moisture depth. Growth was possibly regulated by soil temperature.

Antelope bitterbrush began growth prior to longflower snowberry in all three years at site 07-7 (Figure 7). There was considerably annual fluctuation in both species relative to the onset of leaf and twig growth.

Full bloom for desert globemallow occurred up to five weeks apart between the three years (Figure 8), but was within a one to two week period for phlox (Phlox sp.).

Grass exhibited a great variation among phenophases (Figure 9), although fairway wheatgrass began dissemination during the same week for all three years.

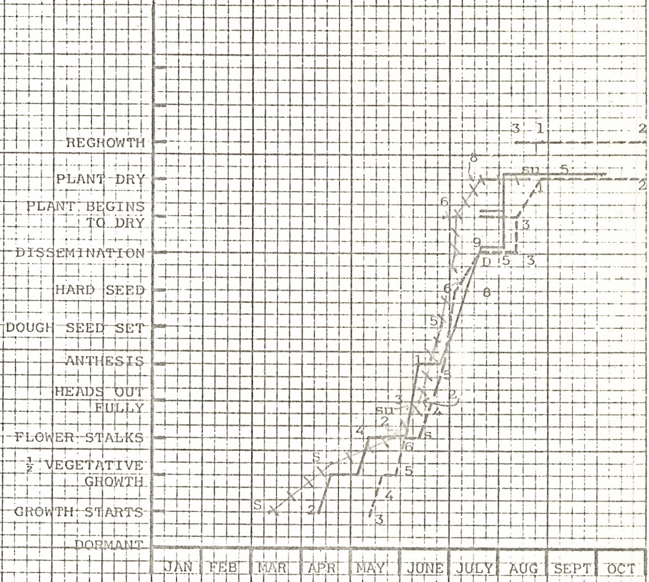


Fig. 1 . Occurrence of phenophases of Sitanion hystrix as compared to soil moisture depth (inches) in northern desert shrub vegetation (site 07-3), Carroll Summit.

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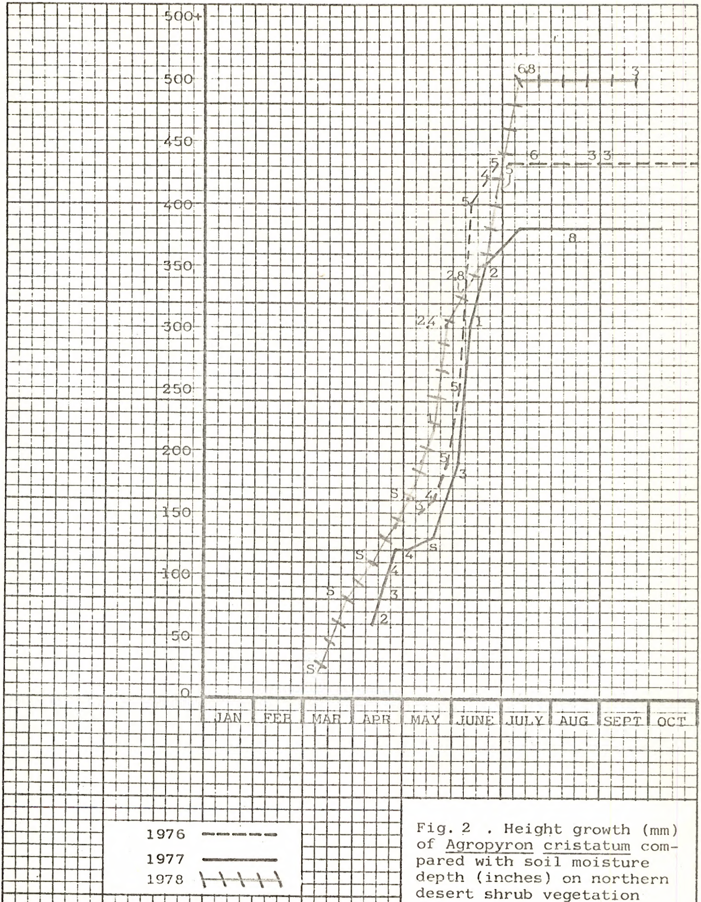

Fig. 2 . Height growth (mm) of Agropyron cristatum compared with soil moisture depth (inches) on northern desert shrub vegetation (site 07-3), Carroll Summit.

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GENE DIETZGEN CO.
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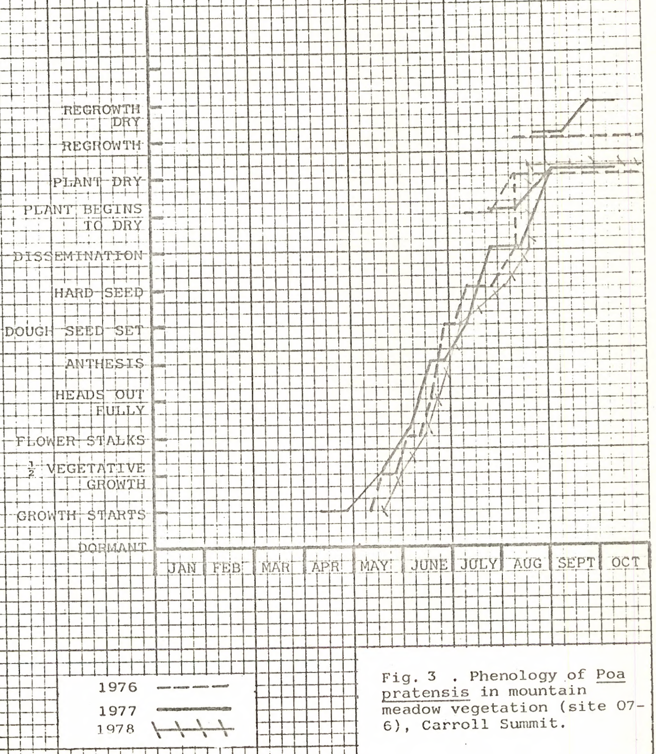

Fig. 3 . Phenology of _Poa pratensis_ in mountain meadow vegetation (site 07-6), Carroll Summit.

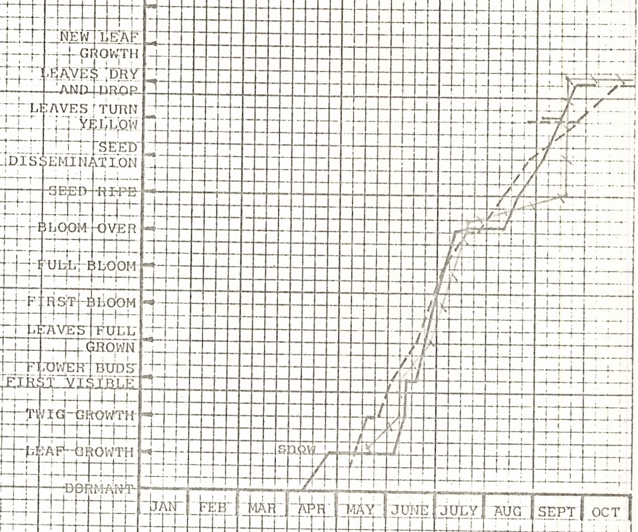

Fig. 4 . Phenology of Symphoricarpos longiflorus on mountain brush vegetation (site 07-7), Carroll Summit.

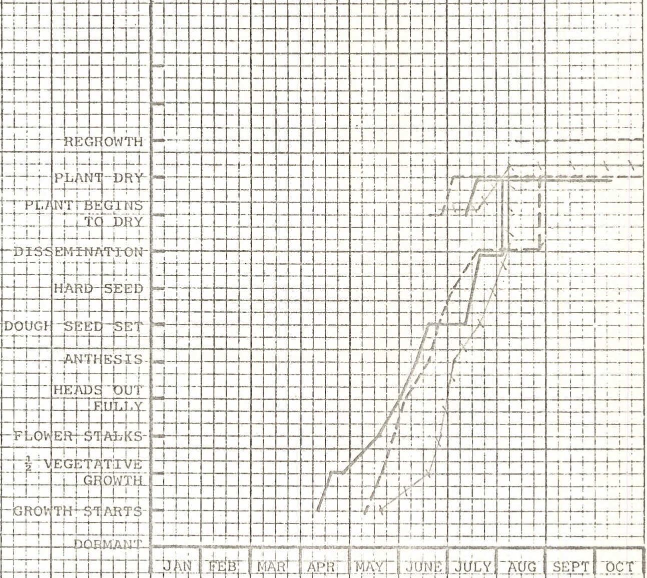

Fig. 5 . Phenology of Poa sandbergii in mountain brush vegetation (site 07-7), Carroll Summit.

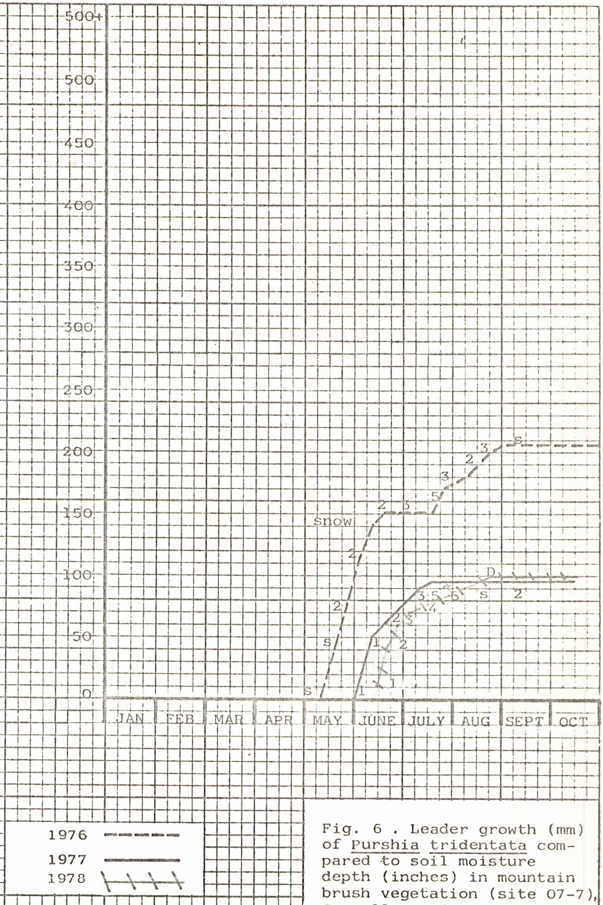

Fig. 6 . Leader growth (mm) of Purshia tridentata compared to soil moisture depth (inches) in mountain brush vegetation (site 07-7), Carroll Summit.

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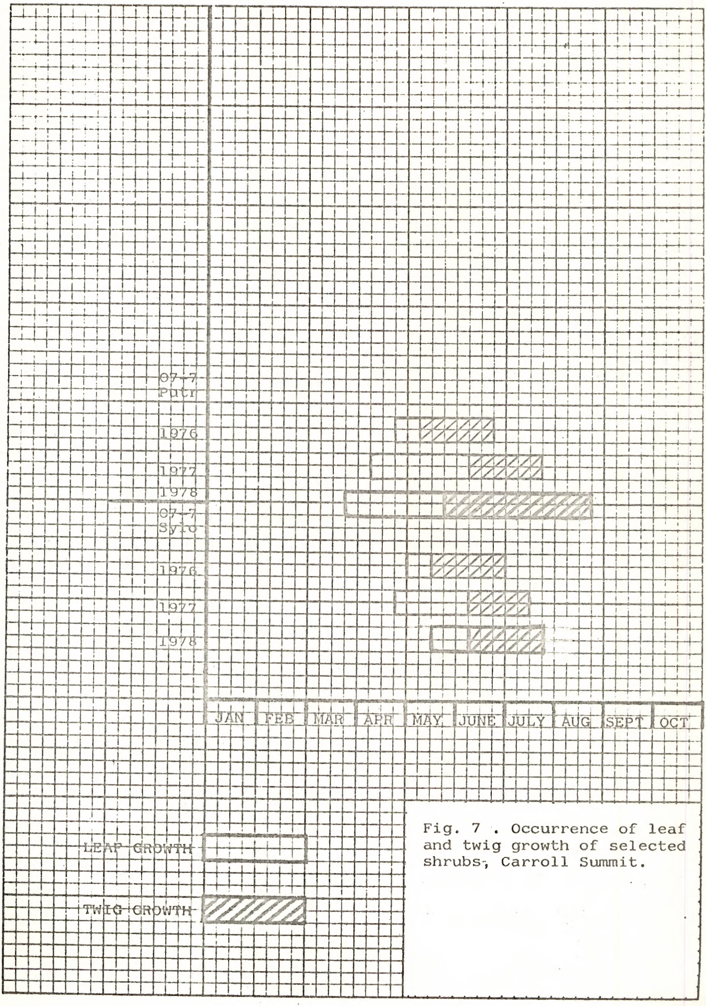

Fig. 7 . Occurrence of leaf and twig growth of selected shrubs, Carroll Summit.

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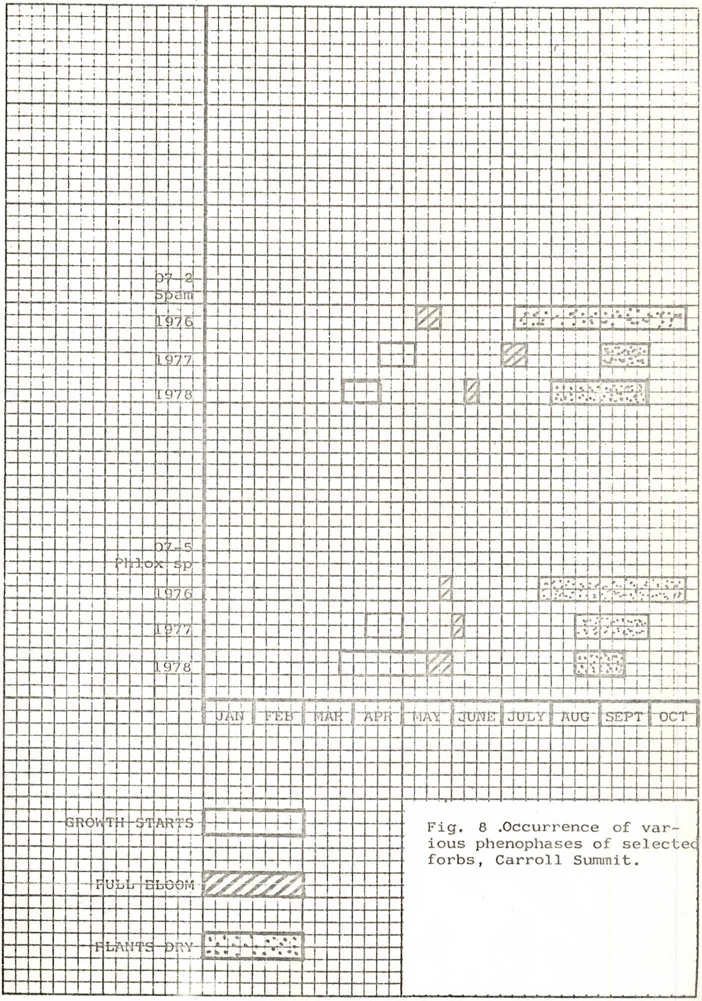

Fig. 8 .Occurrence of various phenophases of selected forbs, Carroll Summit.

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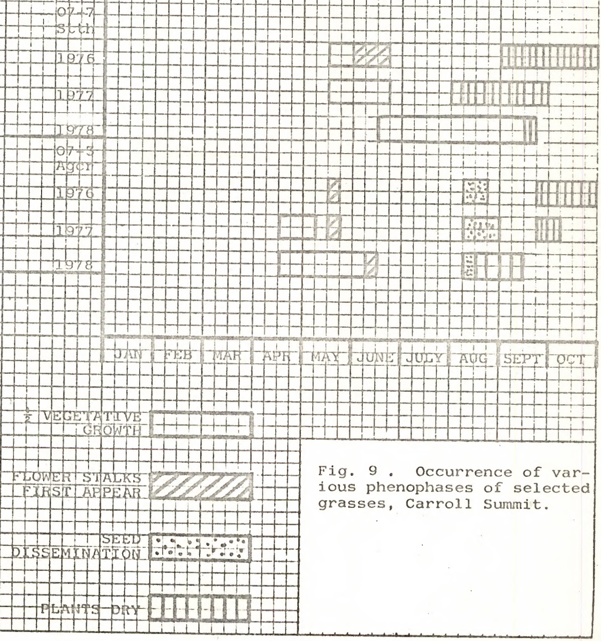


Fig. 9 . Occurrence of various phenophases of selected grasses, Carroll Summit.

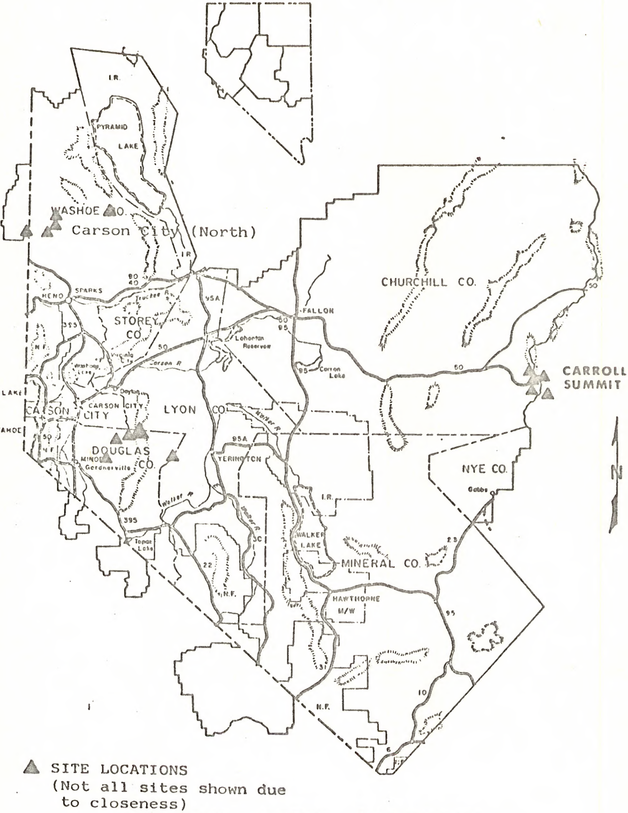
Table 1. Leader (Shrubs) and Height (Grasses) Growth at Carroll Summit (Carson City and Battle Mountain Districts) for 1976, 1977, and 1978.

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 07-2						
SHRUBS						
1. Saba	50		35		70	
2. Grsp	85		85		150	
3. Arsp	35		25		40	
4. Chvi	140		120		130	
5. Atco	100		100		180	
6. Cela	150		200		250	
7. Epne	145		175		220	
GRASSES						
1. Brte	200	30	170		250	30
2. Sihy			140		210	60
3. Orhy			200		345	140
4. Agcr			500		400	90
FORBS						
1. Phra	250	3	175		90	
2. Hagl	130		185		170	
3. Maloc sp.	90				100	
4. Spam	200	50	180		350	
Site 07-3						
SHRUBS						
1. Artr	140		170		215	
2. Chvi	90		130		160	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 07-3 Con't						
3.Chna	180		230		225	
4.Epne	100		130		145	
GRASSES						
1.Posa	70		200		230	50
2.Brte	130		150		160	35
3.Sihy	210		180		250	110
4.Agcr	430		380		500	140
FORBS						
1.Lomat sp.	40		20		80	
2.Erci			10		130	50
3.Crac					95	
4.Delph sp.					350	
Site 07-5						
SHRUBS						
1.Artr	60		150		180	
2.Chvi	95		160		110	
3.Eriog sp.	25	20	90		100	leaf growth
GRASSES						
1.Brte	150	40	160		120	20
2.Sihy	170	80	180		200	70
3.Posa	200	50	200		245	40
4.Stth	250	60	170		310	green-up
FORBS						
1.Phlox sp.	30	4	18		20	1
2.Lupin sp.	130		150		200	
3.Aswh	30		25		45	

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 07-6						
GRASSES						
1.Carex sp.	120		150		220	30
2.Sihy	400	80	360		500	60
3.Popr	450	80	540	170	600	150
4.Posa			360		450	160
FORBS						
1.Taof	15		70	70	60	20
2.Vipu	35		45		40	12
3.Senec sp.			80		400	
4.Aster sp.			280		310	
5.Aggl			140		90	
6.Libu			150		250	
Site 07-7						
SHRUBS						
1.Sylo	150		100		160	
2.Artr	150		190		170	
3.Rive	90		230		105	
4.Chvi	110		100		200	
5.Putr	150	55	95		90	
GRASSES						
1.Posa	300	60	350		310	80
2.Stth	250	50	140		160	
3.Sihy	180	60	250		330	30
FORBS						
1.Vipu	35		20		35	8

	Millimeters					
	1976	Regrowth	1977	Regrowth	1978	Regrowth
Site 07-7 con't						
2.Lupin sp.	110		70		130(grazed)	
3.Liliu sp.			280		100(grazed)	
4.Phlox sp.	35		20	3	28	
5.Senec sp.	60		50		70	
6.Libu	20				could not find	
7.Aggl	150		45		70	
8.Astra sp.	30				could not find	
9.Saka	300				190	



CARSON CITY DISTRICT

SYMBOL 1978		FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)				S 30		2 30		1 30	1 30	S 30	S 30	3 30	6 30			9 30	11 30	14 30	17 30		22 30		6 30		D				7 30							
Precip.(mm)									12			0	0	1			1	0	0		0		12		1				48							
S.T.-°C						15		17	14	13	10	19	16	15			16	13	15		15		17						16							
Carroll Sum. 07-2																																				
SHRUBS																																				
Saba	♀			D		LG, BV		TG			1B		FB				SR		SD		LY				LD				D							
	♂			D		LG, BV		TG			1B	BO	SR	SD							LY				LD				D							
Grsp	♀			LG		BV		TG				1B		FB		BO	SR	SD, LY	LD										D							
	♂			LG		BV		TG		FG		FB	BO			SD		SD, LY	LD										D							
Arsp				LG		TG BV				FG	1B	BO					SR	SD LY	SD, LD				LD						D							
Chvi				LG				TG									BV	BV LY	FG, LY				1B LY		BO, LD				SR, LD							
Atco	♀			LG				TG	BV		FG	1B		FB		BO	SR	SD LY					LY						LD							
	♂			LG				TG										TG LY					LY						LD							
Epne				D					BV			TG		1B		BO	SR	SD					LY													
Cela				LG				TG									BV	1B	BO				BO, LY													

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
SMD(From-To in cm)																																		
Precip.(mm)																																		
S.T.-°C																																		
07-2 Con't.																																		
GRASSES																																		
Brte			GS						½V		FS	HO			An BD	HS BD	SD BD	SD PD						PD				GS						
Sihy			GS					½V				FS	HO			HS BD	SD BD			SD PD				PD				GS						
Orhy			D		GS			½V			FS		HO		DS		HS	SD BD				PD						GS						
Agcr			GS					½V					FS		HO		An	DS BD				HS BD		SD PD				GS						
FORBS																																		
Phra			D							GS		FS	FB		BO		BO BD	SR BD		DS PD		PD												
Hagl			D					GS												FS				1B				SR						
Maloc sp.			D						GS	FS			1B		FB	BO	BO BD	DS BD		PD														
Spam			D		GS			FS					1B		FB	BO	SR BD	DS BD						PD										

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)			S 30		S 30		S 30	S 30	S 30	S 30	1 30	4 30	6 30		7 30	11 30	13 30	17 30		21 30		13 30		D				8 30							
Precip.(mm)								12		0	0	0	1			0	0	0		0		–		–				–							
S.T.-°C					15		14	10		10	16	17	14			13	13	15		15		17		–				–							
Carroll Sum. 07-3																																			
SHRUBS																																			
Artr			LG							TG						BV		FG										FB							
Chvi			D		LG			TG								BV				FG LY		1B LY		FB LD				SR LD							
Chna			D				LG						TG									BV		FG				1B							
Epne			D									TG	BV							1B		SR LY						LY							
GRASSES																																			
Posa			GS				½V			FS		HO	An BD		DS BD	HS PD	SD PD					PD						GS							
Brte			GS							½V	FS		HO		An	HS BD		SD PD						PD				GS							
Sihy			GS					½V					FS		HO	An	DS BD	SD BD		SD PD				PD				GS							
Agcr			GS					½V							FS	HO	An	DS		DS BD		HS BD		SD PD				GS							

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)																																			
Precip.(mm)																																			
S.T.-°C																																			
07-3 Con't.																																			
Forbs																																			
Lomat sp.			GS		FS		1B	FB			BO		BO		SR BD	DS PD	PD																		
Crac			D					GS								BD		PD																	
Erci			D							GS	FS	1B	BO		SR	DS BD		PD																	
Delph sp.			D					FS				1B	FB		BO			SR BD		DS BD		PD													

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)			S 30		1 30		S 30	S 30	S 30	S 30		4 30	4 30		5 30	7 30	8 30	12 30		16 30		7 30		D				7 30							
Precip.(mm)								12		37		1	0		0	0	0	0		0		12		0				70							
S.T.-^{o}C			Sn		15		13	15	14	13		18	13			13	13	15		14		14						-							
Carroll Sum. 07-5																																			
SHRUBS																																			
Artr			LG									TG						BV		FG								FB							
Chvi			D		LG							TG						BV				FG		1B LY				SR LY							
Eriog sp.			LG									FG	1B	BO		SR	SD			LY		LD						LG							
Eriog sp.			LG							BV		TG FB				BO		SD		SD LY		LD						LG							
GRASSES																																			
Brte			GS									FS	HO	An		DS	HS BD	SD BD						PD				GS							
Sihy			D		GS			$\frac{1}{2}$V					FS	HO			An	HS BD		SD BD		SD PD		PD				GS							
Posa			GS							$\frac{1}{2}$V		HO	An	DS		gr				PD								GS							
Stth			D		GS							$\frac{1}{2}$V		FS		gr												gu							
FORBS																																			
Phlox sp.			D		GS							FB		BO			SR	DS		BD				PD				GS							

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV
SMD(From-To in cm)																																		
Precip.(mm)																																		
S.T.-°C																																		
07-5 Con't.																																		
Lupin sp.			D				GS					FS	1B	FB		BO		SR		DS BD								PD						
Aswh			D		GS			FS				BO		DS			DS BD			PD														
Casti sp.			D						GS			FS	1B	FB		gr																		
Liliu sp.			D					GS						FS		gr																		
Arabi sp.			D					GS		FS		1B	BO				SR	DS PD						PD										

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)																																			
Precip.(mm)																																			
S.T.-°C																																			
Carroll Sum. 07-6																																			
SHRUBS - NONE																																			
GRASSES			SNOW				SNOW																												
Carex sp.										GS		½V			FS	An		DS				HS		HS PD				GS							
Sihy										D		GS ½V					FS	HO		An		SD BD		SD PD				GS							
Popr										D		GS ½V			FS	HO		DS				HS BD		SD PD				GS							
Posa										GS		½V			FS	HO		DS		HS BD		SD BD		SD PD				GS							
FORBS																																			
Taof										D		GS 1B			FB	DS				BD				PD				GS							
Vipu										GS		1B			FB	BO		DS BD						PD				GS							
Senec sp.										GS	FS				1B	FB	BO	DS BD		PD															

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD(From-To in cm)																																			
Precip.(mm)																																			
S.T.-°C																																			
07-6 Con't.			snow				snow																												
Aggl										GS					FS	1B	BO			SR		PD													
Libu										GS			FS		1B	FB	BO	SR		PD															
Aster sp.										D										GS		1B		FB				SR PD							

SYMBOL 1978	FEB	MARCH				APRIL				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV	
SMD (From-To in cm)			SNOW			SNOW				SNOW		S 30	3 30		4 30	5 30	8 30	8 30		11 30		13 30		D				5 30							
Precip. (mm)			SNOW			SNOW				SNOW			1		-	1		0		0		6		0				67							
S.T.-°C			SNOW			SNOW				SNOW		10	11		-	14	11	-		11		11		-				-							
Carroll Sum. 07-7																																			
SHRUBS																																			
Sylo												LG			TG BV		FG	1B		BO								SR LD							
Artr												LG			TG			BV				FG						FB							
Ribes sp.												LG BV	1B		TG BO													SD LD							
Chvi												D	LG		TG					BV				1B LY				BO LY							
Putr			D		LG								TG BV		1B	BO				SD				LY											
GRASSES																																			
Posa												GS				½V	FS BD	An BD		DS BD		SD PD		PD				GS							
Stth												GS			½V							½V BD						PD							
Sihy												GS			½V			FS		An		SD BD						GS							

SYMBOL 1978	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
SMD(From-To in cm)										
Precip.(mm)										
S.T.-°C										
07-7 Con't.										
FORBS										
Vipu				GS FS		BD PD		GS		
Lupin sp.				GS	FS	FB BO	gr			
Liliu sp.				GS	FS	gr				
Phlox sp.				GS	FS 1B FB	BO DS	BD PD			
Senec sp.				GS	GS BD	PD				
Aggl				D	GS FS	BD PD				
Saka				D		GS FS	FB	PD		

CEDARVILLE

CEDARVILLE

The Cedarville phenology record is not as complete as some of the other sites, since they did not join the study until late May of 1977. However, their data does provide some important clues relative to species development in the northwest corner of Nevada.

A two year comparison of Sandberg bluegrass (*Poa sandbergii*) phenology shows a strong similarity in development (Figure 1). Flowery phlox (*Phlox multiflora*) growing in the pinyon/juniper woodland shows greater variation (Figure 2), with the 1978 growth pattern lagging several weeks behind that of 1977. Rabbitbrush (*Chrysothamnus viscidiflorus*) in the salt desert shrub type shows well the relative lateness of bloom for this species (Figure 3). The phenology of squirrel-tail grass (*Sitanion hystrix*) in a salt desert shrub type is similar for both years, with the 1978 phenology sometimes ahead and sometimes lagging behind that of 1977. Reasons for this crossing-over effect are not clear.

Height growth of crested wheatgrass (*Agropyron desertorum*) was less and began earlier in 1978 (Figure 5). Twig growth of low sagebrush (*Artemisia arbuscula*) on two salt desert shrub sites occurred later in 1978. Period of twig growth was identical on both sites in 1977, and almost the same in 1978 (Figure 6).

Examination of leader and height growth for the two years (Table 1) shows no definite growth patterns. Better growth occurred in 1977 for some species, and in 1978 for other species.

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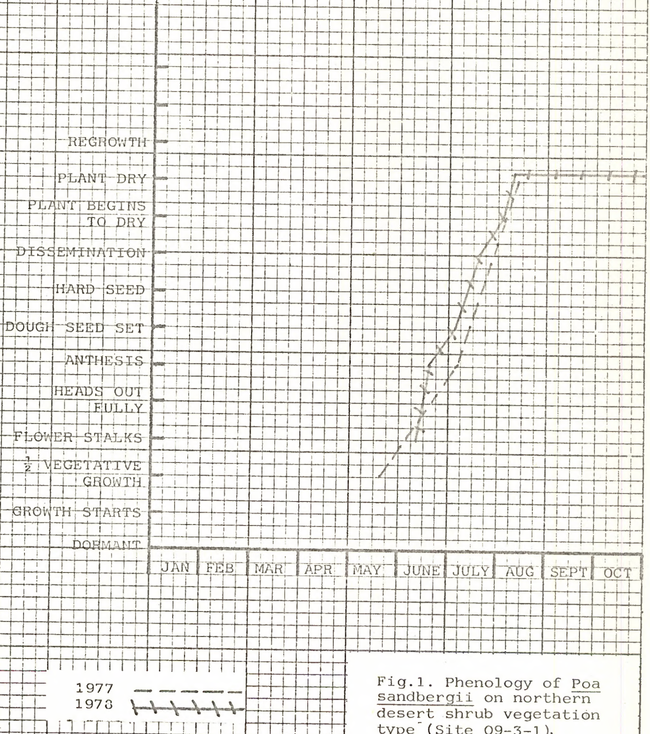

Fig.1. Phenology of Poa sandbergii on northern desert shrub vegetation type (Site 09-3-1), Cedarville (northern Washoe County)

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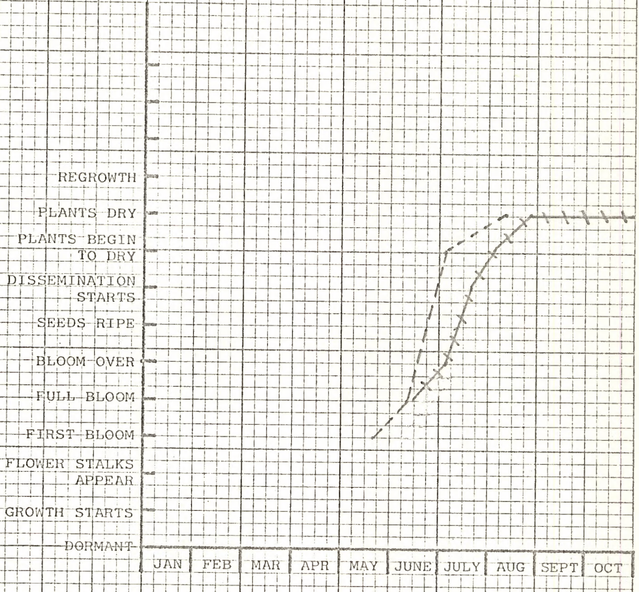

Fig.2. Phenology of *Phlox multiflora* on pinyon-juniper vegetation type (Site 09-5), Cedarville (Northern Washoe County)

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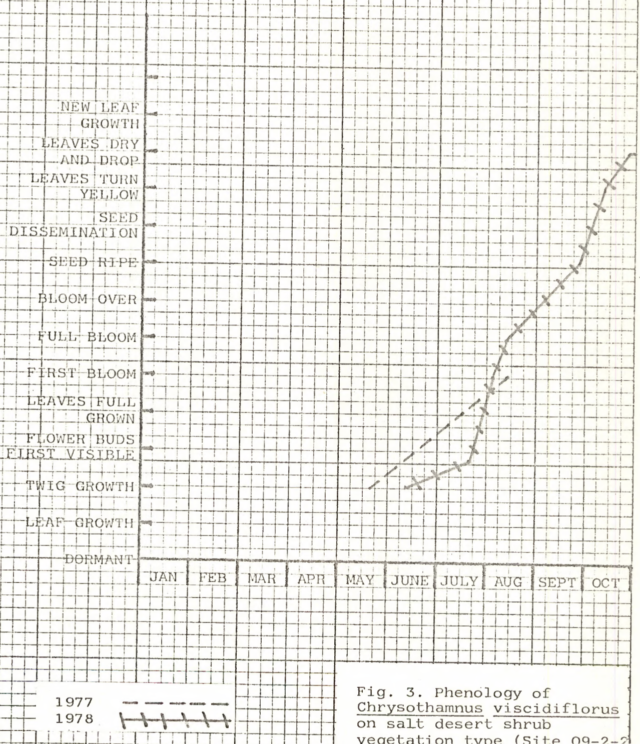

Fig. 3. Phenology of *Chrysothamnus viscidiflorus* on salt desert shrub vegetation type (Site 09-2-2 Cedarville (Northern Washoe County)

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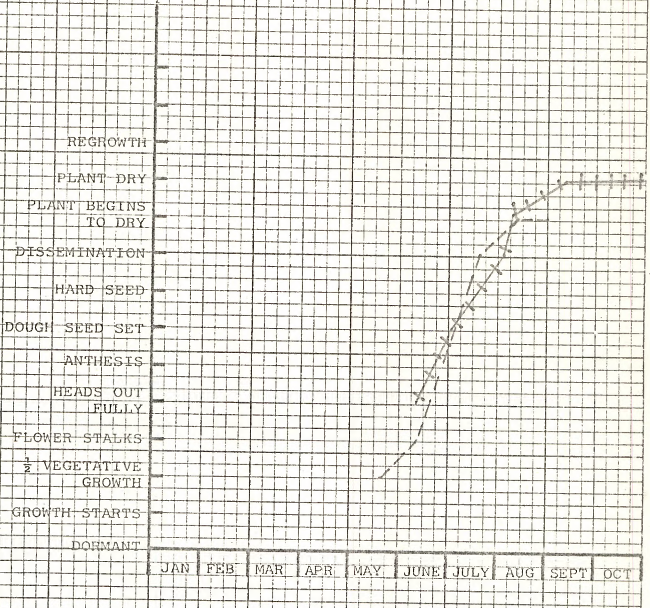

1977	— — — — —
1978	┼┼┼┼┼

Fig.4. Phenology of Sitanion hystrix on salt desert shrub vegetation type (Site 09-2-1), Cedarville (Northern Washoe County)

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8 X 8 PER INCH

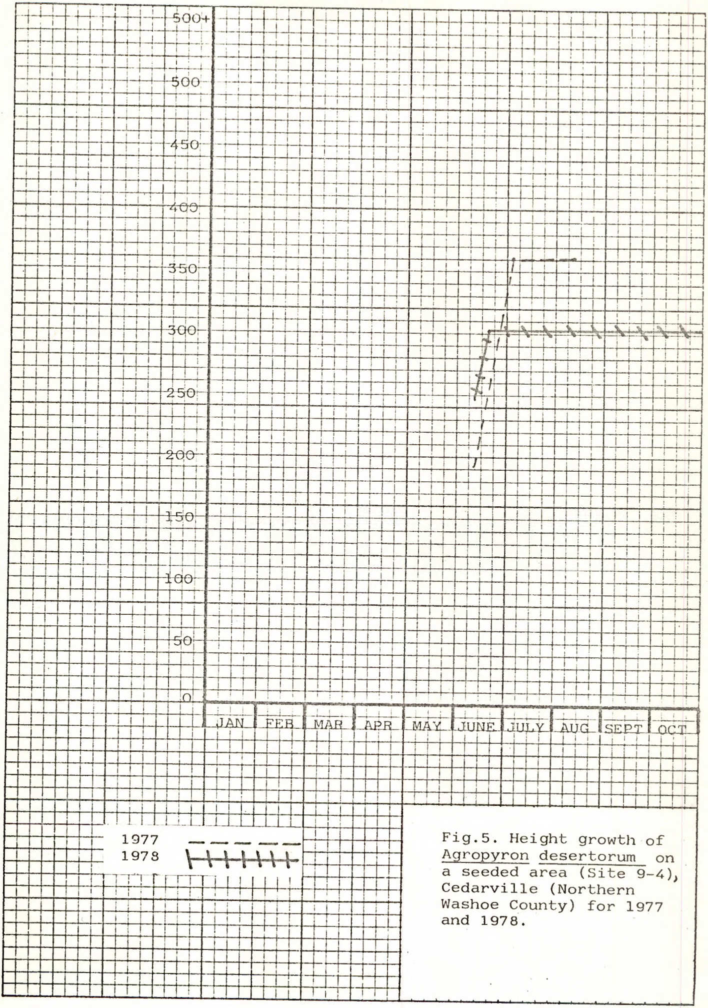

Fig.5. Height growth of Agropyron desertorum on a seeded area (Site 9-4), Cedarville (Northern Washoe County) for 1977 and 1978.

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NO. 340-8 DIETZGEN GRAPH PAPER
8 X 8 PER INCH

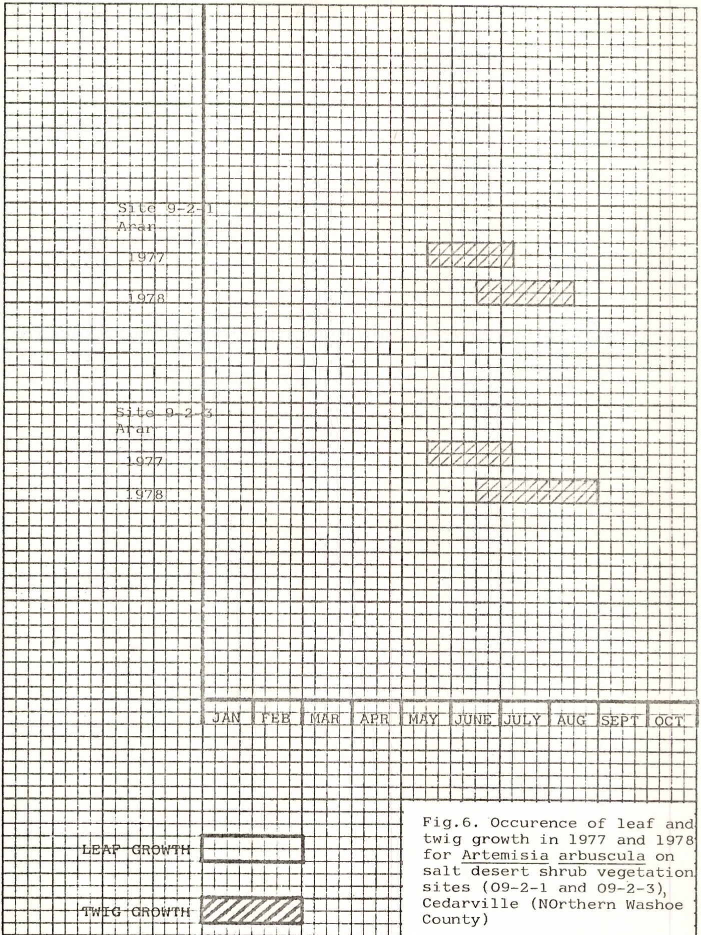

Fig.6. Occurence of leaf and twig growth in 1977 and 1978 for Artemisia arbuscula on salt desert shrub vegetation sites (09-2-1 and 09-2-3), Cedarville (NOrthern Washoe County)

Table 1. Leader (Shrubs) and Height (Grasses) Growth in Cedarville District for 1977 and 1978.

	Millimeters			
	1977	Regrowth	1978	Regrowth
Site 9-2-1				
SHRUBS				
1.Arar	130		194	
GRASSES				
1.Posa	61		41	
2.Sihy	150		190	
FORBS				
1.Trma			61	
2.Phho			80	
3.Lomat			113	
4.Senec			100	
Site 9-2-2				
SHRUBS				
1.Teca	120		209	
2.Artr	120		205	
3.Chvi	120		205	
GRASSES				
1.Agde	360		235	GS*
2.Stco			185	
Site 9-2-3				
SHRUBS				
1.Arar			180	

GS*=growth starts

	Millimeters			
	1977	Regrowth	1978	Regrowth
Site 9-2-3 con't				
GRASSES				
1.Posa			42	
2.Sihy			189	
FORBS				
1.Trma			64	
2.Lomat sp.			90	
3.Erth			59	
4.Phmu			18	
5.Alliu sp.			141	
Site 9-2-4 (Estab.1978)				
SHRUBS				
1.Grsp			230	
2.Save			129	
3.Arsp			50	
4.Artr			203	
5.Atco			83	
GRASSES				
1.Elci			431	
Site 9-3-1				
SHRUBS				
1.Artr	130		161	
2.Chna			170	

	Millimeters			
	1977	Regrowth	1978	Regrowth
Site 9-3-1 con't				
GRASSES				
1.Dist	95		100	
2.Posa	100		63	
3.Pule			107	
FORBS				
1.Logr	50		87	
Site 9-3-3 (Estab.1978)				
SHRUBS				
1.Arar			228	
2.Grsp			155	
GRASSES				
1.Stth			176	
2.Sihy			117	
3.Posa			60	
Site 9-4				
SHRUBS				
1.Chvi	200		155	
2.Artr	150		157	
GRASSES				
1.Sihy	200		166	
2.Stth	230		147	
3.Agde	360		302	GS*
4.Posa	250		49	
5.Carex sp.	90		89	

GS*=growth starts

	Millimeters			
	1977	Regrowth	1978	Regrowth
Site 9-4 con't				
FORBS				
1.Erov	50		45	
Site 9-5-1				
SHRUBS				
1.Arar	120		175	
GRASSES				
1.Posa	45		66	
2.Sihy	220		228	
FORBS				
1.Alliu sp.			129	
2.Senec sp.			128	
3.Lomat sp.			89	
4.Trma			47	
5.Phmu			21	

YMBOL 1978	-	JUNE				JULY				AUG				SEPT				OCT							
MD(From-To in cm)																									
recip.(mm)																									
.T.-°C																									
edarville -02-1																									
HRUBS																									
rar			FG	TG		BV				1B	FB		BO				SR		SD						
RASSES																									
osa			DS			SD				BD	PD														
ihy			HO			DS				SD	BD				PD										
ORBS																									
rma			SR	DS		BD					PD														
hho			FB	BO		SR		DS		BD	PD														
omat sp.			FB	BO		SR				DS	BD		PD												
enec sp.			FB	SR		PD																			

YMBOL 1978	-	JUNE				JULY				AUG				SEPT				OCT																
MD(From-To in cm)																																		
recip.(mm)																																		
.T.-°C																																		
edarville 9-02-2																																		
SHRUBS																																		
Chvi			TG					BV		1B	FB						SF		LY		LD													
Artr			TG			BV				FG			1B		FB		BO		SD		LY													
Teca			TG			1B	FB				BO		SR		LD																			
GRASSES																																		
Agde			FS	DS								SD			BD				GS		PD													
Stco			FS	HO		DS				SD	BD								PD															
FORBS																																		

SYMBOL 1978	-	JUNE				JULY				AUG				SEPT				OCT			
SMD(From-To in cm)																					
Precip.(mm)																					
S.T.-°C																					
Cedarville 9-02-3																					
SHRUBS																					
Arar			FG	TG		BV					1B		FB		BO		SR			SD	
GRASSES																					
Posa			An	DS		SD				BD	PD										
Sihy			FS			An		DS		SD	BD				PD						
FORBS																					
Trma			BD			DS		BD			PD										
Lomat sp.			FB	BO						DS	BD		PD								
Erth				1B		FB				BO	DS				BD		PD				
Phmu			FB			DS		BD			PD										
Alliu sp.			FB	BO				DS		BD	PD										

SYMBOL 1978	-	JUNE				JULY				AUG				SEPT				OCT															
SMD (From-To in cm)																																	
Precip. (mm)																																	
S.T.-^{o}C																																	
Cedarville 9-02-4																																	
SHRUBS																																	
Grsp ♀		BO		SR		SD		LY		LD																							
♂		BO		-		LY		-		LD																							
Save		FG		SD									LY				LD																
Arsp		TG				BO		LY			LD																						
Artr		FG		TG		BV									1B		FB	BO		SR													
Atco		1B				FB					BO				LY		LD																
		FG				FB					BO				LY		LD																
GRASSES																																	
Elci		½V		FS		An		DS		SD	BD		PD																				
FORBS																																	

YMBOL 1978	-	JUNE				JULY				AUG				SEPT				OCT			
MD(From-To in cm)																					
recip.(mm)																					
.T.-°C																					
edarville 9-03-1																					
SHRUBS																					
Artr			TG			BV				FG					1B		BO		SR		SD
Chna			TG					BV		1B	FB				BO		SR		SD		LY
GRASSES																					
Posa			FS	An		DS		SD		BD	PD										
Pule			HO			DS				SD	BD						PD				
Dist			½V														BD		PD		
FORBS																					
Logr			BO			BD				PD											

SYMBOL 1978	-	JUNE				JULY				AUG				SEPT				OCT							
SMD(From-To in cm)																									
Precip.(mm)																									
S.T.-°C																									
Cedarville 9-03-3																									
SHRUBS																									
Arar						BV				FG			1B		FB				BO		SR				
Grsp						SD				LY			LD												
GRASSES																									
Stth						SD				BD					PD										
Sihy						SD				BD	PD														
Posa						BD				PD															
FORBS																									

SYMBOL 1978	-	JUNE	JULY	AUG	SEPT	OCT				
SMD (From-To in cm)										
Precip. (mm)										
S.T.-°C										
Cedarville										
9-04										
SHRUBS										
Chvi		TG	BV	1B FB	BO SR	LY LD				
Artr		TG	BV	FG	1B BO	SD LY				
GRASSES										
Sihy		FS HO	DS	SD BD	PD					
Stth		FS An	DS	BD	PD					
Agde		FS HO	DS	HS SD	BD	GS PD				
Posa		An HS	BD	PD						
Carex sp.		An	HS BD	PD						
FORBS										
Erov		FB	BO	DS	BD PD					

SYMBOL 1978	-	JUNE				JULY				AUG				SEPT				OCT																	
SMD(From-To in cm)																																			
Precip.(mm)																																			
S.T.-°C																																			
Cedarville 9-05-1																																			
SHRUBS																																			
Arar			FG	TG		BV					1B		FB		BO		SR		SD																
GRASSES																																			
Sihy			½V			HO		DS		SD			BD				PD																		
Posa			DS							SD	BD		PD																						
FORBS																																			
Alliu sp.			FB			BO				DS	PD																								
Senec sp.			FB			SR		DS		BD	PD																								
Lomat sp.			FB	BO				DS		BD			PD																						
Phmu			FB			BO		DS		BD			PD																						
Trma			BO					SR		DS	PD																								

APPENDIX I

Appendix I. Symbol and scientific name (alphabetically by symbol) of species presented in phenodynamic tables.

SYMBOL	SCIENTIFIC NAME
SHRUBS:	
Amal	*Amelanchier alnifolia*
Amdu	*Ambrosia dumosa*
Amut	*Amelanchier utahensis*
Arar	*Artemisia arbuscula*
Arno	*Artemisia nova*
Arpa	*Arctostaphylos patula*
Arsp	*Artemisia spinescens*
Artr	*Artemisia tridentata*
Atca	*Atriplex canescens*
Atco	*Atriplex confertifolia*
Atle	*Atriplex lentiformis*
Bere	*Berberis repens*
Cegr	*Ceanothus greggii*
Cela	*Ceratoides lanata*
Cele	*Cercocarpus ledifolius*
Cepr	*Ceanothus prostratus*
Ceve	*Ceanothus velutinus*
Chna	*Chrysothamnus nauseosus*
Chvi	*Chrysothamnus viscidiflorus*
Come	*Cowania mexicana*
Cora	*Coleogyne ramosissima*

SYMBOL	SCIENTIFIC NAME
Cost	*Cowania stansburiana*
Dafr	*Dalea fremontii*
Epne	*Ephedra nevadensis*
Epvi	*Ephedra viridis*
Eriog sp.	*Eriogonum*
Grsp	*Grayia spinosa*
Haco	*Haplopappus cooperi*
Hodi	*Holodiscus discolor*
Hodu	*Holodiscus dumosus*
Juos	*Juniperus osteosperma*
Krpa	*Krameria parvifolia*
Ladi	*Larrea divaricata*
Lepu	*Leptodactylon pungens*
Lysp	*Lygodesmia spinosa*
Mare	*Mahonia repens*
Potr	*Populus tremuloides*
Potr3	*Populus trichocarpa*
Pran	*Prunus andersonii*
Prju	*Prosopis juliflora*
Prvi	*Prunus virginiana*
Putr	*Purshia tridentata*
Riau	*Ribes aureum*
Ribes sp.	*Ribes*
Rice	*Ribes cereum*
Rive	*Ribes velutinum*
Rosa sp.	*Rosa*

SYMBOL	SCIENTIFIC NAME
Rowo	*Rosa woodsii*
Saal	*Salix alba*
Saba	*Sarcobatus baileyi*
Saca	*Salix cascadensis*
Salix sp.	*Salix*
Save	*Sarcobatus vermiculatus*
Syal	*Symphoricarpos albus*
Sylo	*Symphoricarpos longiflorus*
Symph sp.	*Symphoricarpos*
Syoc	*Symphoricarpos occidentalis*
Teca	*Tetradymia canescens*
Tegl	*Tetradymia glabrata*
Yubr	*Yucca brevifolia*
GRASSES:	
Agal	*Agrostis alba*
Agcr	*Agropyron cristatum*
Agda	*Agropyron dasystachyum*
Agde	*Agropyron desertorum*
Agin Ag	*Agropyron intermedium*
Agrop sp.	*Agropyron*
Agros sp.	*Agrostis*
Agsm	*Agropyron smithii*
Agsp	*Agropyron spicatum*
Agst	*Agrostis stolinifera*
Agtr	*Agropyron trachycaulum*

SYMBOL	SCIENTIFIC NAME
Bogr	*Bouteloua gracilis*
Brca	*Bromus carinatus*
Brin	*Bromus inermis*
Brja	*Bromus japonicus*
Brte	*Bromus tectorum*
Cane	*Calamagrostis neglecta*
Carex sp.	*Carex*
Deca	*Deschampsia caespitosa*
Disti sp.	*Distichlis*
Dist	*Distichlis stricta*
Elci	*Elymus cinereus*
Eltr	*Elymus triticoides*
Feid	*Festuca idahoensis*
Feme	*Festuca megalura*
Hija	*Hilaria jamesii*
Hiri	*Hilaria rigida*
Hobr	*Hordeum brachyantherum*
Juba	*Juncus balticus*
Juncu sp.	*Juncus*
Kocr	*Koeleria cristata*
Muri	*Muhlenbergia richardsonis*
Orhy	*Oryzopsis hymenoides*
Orwe	*Oryzopsis webberi*
Poam	*Poa ampla*
Pobu	*Poa bulbosa*

SYMBOL	SCIENTIFIC NAME
Pocu	*Poa cusickii*
Pofe	*Poa fendleriana*
Pone	*Poa nevadensis*
Popr	*Poa pratensis*
Posa	*Poa sandbergii*
Pule	*Puccinellia lemmoni*
Sece	*Secale cereale*
Sihy	*Sitanion hystrix*
Spai	*Sporobolus airoides*
Stco	*Stipa comata*
Stipa sp.	*Stipa*
Stth	*Stipa thurberiana*
Stwe	*Stipa webberi*
FORBS:	
Acca	*Aconitum columbianum*
Acla	*Achillea lanulosa*
Acmi	*Achillea millefolium*
Aggl	*Agoseris glauca*
Alliu sp.	*Allium*
Arabi sp.	*Arabis*
Argem sp.	*Argemone*
Arlu	*Artemisia ludoviciana*
Asle	*Astragalus lemmonii*
Aster sp.	*Aster*

SYMBOL	SCIENTIFIC NAME
Astra sp.	*Astragalus*
Aswh	*Astragalus whitneyi*
Basa	*Balsamorhiza sagittata*
Casti sp.	*Castilleja*
Cirsi sp.	*Cirsium*
Clema sp.	*Clematis*
Crac	*Crepis acuminata*
Delph sp.	*Delphinium*
Erci	*Eriodium cicutarium*
Eriog sp.	*Eriogonum*
Erca	*Eriogonum caespitosum*
Erov	*Eriogonum ovalifolium*
Erth	*Eriogonum thomasii*
Fraga sp.	*Fragaria*
Haar	*Haplopappus armerioides*
Hagl	*Halogeton glomeratus*
Halog sp.	*Halogeton*
Haplo sp.	*Haplopappus*
Hyca	*Hydrophyllum capitatum*
Iris sp.	*Iris*
Irmi	*Iris missouriensis*
Lepe	*Lepidium perfoliatum*
Libu	*Lithophragma bulbifera*
Liliu sp.	*Lilium*
Logr	*Lomatium grayi*

SYMBOL	SCIENTIFIC NAME
Lomat sp.	*Lomatium*
Lone	*Lomatium nevadense*
Lotr	*Lomatium triternatum*
Luca	*Lupinus caudatus*
Lule	*Lupinus leucophyllus*
Lupin sp.	*Lupinus*
Lysp	*Lygodesmia spinosa*
Maca	*Machaeranthera canescens*
Maloc sp.	*Malocathrix*
Mear	*Mentha arvensis*
Meob	*Mertensia oblongifolia*
Merte sp.	*Mertensia*
Mesa	*Medicago sativa*
Migu	*Mimulus guttatus*
Onobr sp.	*Onobrychis*
Peki	*Penstemon kingii*
Penst sp.	*Penstemon*
Pepa	*Penstemon palmeri*
Pesi	*Pediocactus simpsoni*
Phace sp.	*Phacelia*
Phho	*Phlox hoodii*
Phlo	*Phlox longifolia*
Phlox sp.	*Phlox*
Phmu	*Phacelia mustelina*
Phra	*Phacelia ramosissima*
Plma	*Plantago major*

SYMBOL	SCIENTIFIC NAME
Popa	Potentilla pacifica
Poten sp.	Potentilla
Ragl	Ranunculus glaberrimus
Ranun sp.	Ranunculus
Rate	Ranunculus testiculatus
Rumex sp.	Rumex
Saka Salsola	Salsola kali
Senec sp.	Senecio
Sial	Sisymbrium altissimum
Sidel sp.	Sidalcea
Spam	Sphaeralcea ambigua
Sphae sp.	Sphaeralcea
Taof	Taraxacum officinale
Tarax sp.	Taraxacum
Thmo	Thermopsis montana
Trma	Trifolium macilentum
Veca	Veratrum californicum
Veth	Verbascum thapsus
Viad	Viola adunca
Viola sp.	Viola
Vipu	Viola purpurea
Wyeth sp.	Wyethia
Zigad sp.	Zigadenus
Zipa	Zigadenus paniculatus

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